Pub. Engl. - Gt Brit.

THE

PALLADIUM-SUPPLEMENT,

ENLARGED. (PRICE 1s.)

For the Year of our LORD, 1764.

CONTAINING

The NATURE, USEFULNESS, and CERTAINTY, of the *Mathemathematical* SCIENCES.

The *Inſufficiency* of Mr. HARRISON's WATCH (or any other TIME-PIECE) for *diſcovering the Longitude at Sea*; with enumerated *Objections*, and his *Proceedings* examined.

The PRACTICAL METHOD of diſcovering the *Longitude*, now under Conſideration, by *Obſervers* of it, ſent by the Government to the *Weſt Indies.*

New Aſtronomical TABLES, and EQUATIONS in Time, of the *Moon* from the *Sun*; with Precepts and Examples for computing (in the *ſhorteſt Way)* the true Times of ECLIPSES, and of all the NEW and FULL MOONS, forever, ſince *Creation.*

Correcting ſeveral public *Errors* in ASTRONOMY and NAVIGATION.

Adapted for the USE of SEAMEN.

Humbly inſcribed to the COMMISSIONERS of the *Longitude.*

By the AUTHOR of the *Royal Aſtronomer and Navigator.*

MVSEVM BRITANNICVM

Learn of the little Nautilus *to ſail,*
Spread the thin Oar, and catch the driving Gale.
POPE.

LONDON:
Printed for JOHN FULLER, in *Blow-Bladder Street.*
M.DCC.LXIV.

2

PREFACE.

AS in the following Account of *Truth* there is a Leſſon of INSTRUCTION to every *Proficient*, as well as *Beginner*, in Science; ſo we likewiſe offer it to thoſe who render *plain Things difficult*, *compound the ſimple and complex*, *confound the diſtinct and identical*, *involve Day-light and Truth in Obſcurity and Error*; tranſforming the *genuine* Method of Fluxions into the ſpecious Doctrines of *Ghoſts* of *departed Quantities*, into the Doctrine of *Ultimators*, and that of *reſidual Analyſis*, the old general Methods of ſolving *Maxima* and *Minima* into particular new Ones, and alſo variable into uniform *Motion*, by the Means of a *Kennedian* Alchemy. We therefore hope, that every ſincere Lover and Encourager of true Science will *unite* in oppoſing and overthrowing the *Eſtabliſhers of Error*; *viz.* the whole Race of Pretenders to Truth and Science, *Berkleyians*, *Hutcheſonians*, *Romainians*, *Kennedians*, *Rivetians*, *Ferguſonians*, *&c.*

Of the NATURE, USEFULNESS, *and* CERTAINTY, *of the* MATHEMATICS. *According to Mr.* Emerſon's *celebrated* Cyclomatheſis.

AS Man is endued with the noble Faculty of Reaſon, and likewiſe with a ſtrong innate Deſire of Knowledge, it is natural for him to exert this his diſtinguiſhing Talent in the Purſuit of Knowledge. *Truth* alone is the Object of *Knowledge*; for is it poſſible to know a falſe Thing to be true? and Evidence is the certain Mark or Criterion of Truth; and this conſiſts in the Perception of the Agreement or Diſagreement of our *Ideas* in the Mind, according as the Things in Nature agree or diſagree. As there is no ſtronger Paſſion in the human Soul than the Love of Truth, and no greater Deſire for any Thing than to find it out; ſo when it is found, there is no greater Pleaſure to the Underſtanding than the Contemplation thereof in the ſeveral Branches of Science, even when the Search of it is attended with the greateſt Labour and Pains. *Truth* is of ſuch a Nature as always to be conſiſtent with itſelf, and needs Nothing to enforce or recommend it but its own native Evidence. It is but one ſimple, uniform, invariable, Thing, whilſt its oppoſite, *Falſhood*, is infinitely various, inconſiſtent, and contradictory.

As *Truth* is what all Men admire, and every one aims at, and *Error* what every Man hates that is not blinded by *Self-Intereſt*, it is neceſſary that we take Care never to receive any Thing for Truth which does not bring its *proper Evidence* along with it. For it is *Evidence* alone that can gain our Aſſent and remove all our *Doubts*; and when that appears, the Mind can neither expect or deſire any Thing farther. By the Help of this we are enabled to diſtinguiſh *Truth* from *Falſhood*, *Right* from *Wrong*, and we likewiſe have a Power of ſuſpending our Aſſent till that *Evidence* appears; and when it does appear, it compels our *Aſſent* and carries abſolute Conviction. *Truth*, when expreſſed in Words, is the ſame Thing as a *true Propoſition*; and as *Evidence* is a neceſſary Voucher for Truth, we ought never to give aſſent to a doubtful or obſcure Propoſition; but ſhould deny it as long as we can, and not give our Judgement, as long as we can withhold it, in ſuch Things as we can have an evident Knowledge of.

Now, ſince Truth is of ſo amiable a Nature, and ſo deſirable to the Underſtanding, it will be aſked, where it is to be found? and how ſhall we come to the Knowledge of it? I anſwer, it is to be found in the Writings of the *Mathematicians*, where the Method of finding it is clearly explained. In the *mathe-*

Lines, found to be *curved*; which *Deviation* from *right* Lines we have ſhewn farther on. — Mr. *Weſt*'s true *Propoſition* XXI. in the *1ſt Edition*, by which the ſame is proved, is omitted or ſtruck out in the *altered Edition*, as untrue. But to do Juſtice to this ingenious *Author*'s Memory, and the Subſcribers to, and Buyers of, the *1ſt Edition*, we have reſtored the ſaid XX. and XXI. *Propoſitions*, for the *Navigator* and *mathematical Reader* to judge of, as there may be ſeveral new Projections of the Sphere, in which may be ſome uſeful *Properties*: Eſpecially, as Mr. *Weſt*'s new *Projection* thereof (on a Line of *Tangents* from the Earth's Center, upon the curved Surface of its circumſcribing Cylinder opened to a *Plane)* may furniſh Hints of *Improvement* for making a more commodious or perfect *Sea Chart* than any we have at preſent, of which *Mercator*'s is reckoned the trueſt; though ſaid to be not free from *Defects* in the *Rhumb Lines*.

The two *Propoſitions* introduced by the Editor in Mr. *Weſt*'s altered *Edition* of *Mathematics*, inſtead of his XXth erroneous one, and XXIſt true one, are theſe following.

Editor's XX. *To find the Sum of two Lines, a* Maximum, *one drawn from a given Point in the Circle's Diameter, (betwixt the Center and Periphery thereof) and the other from the contrary Extreme of that Diameter, to a required Point in the Periphery.*

Editor's XXI. *To draw the* Parabola, Ellipſis, *and* Hyperbola, *upon the ſame given Parameter.*

As we, in general, admire Mr. *Weſt*'s *Mathematics*, containing the *Principles of Fluxions*, and *Rules* of that ſublime *Science*, deduced in a ſhort Compaſs, with *elegant* and *eaſy* Solutions to ſeveral *pretty Problems*, (wherein the Author has ſhewn a mathematical Genius and Judgement) we have given the following *Errata* printed in the 1ſt Edition, not inſerted in the altered or (what is called) 2d Edition. With ſome *Emendations* intended for the Author's Reputation and the Reader's Satisfaction.

That while we judged *(ſee* Pal. 1764, *P.* 108) Mr. *Weſt*'s *Mathematics* to be *uſeful to Learners and pleaſing to Proficients*, we alſo judge that Mr. EMERSON's FLUXIONS in *Octavo*, (wherein that whole Doctrine is accurately explained and made familiar to every common Capacity) *is much more uſeful and ſatisfactory to Beginners and Proficients, and moſt fit for the Uſe of Schools; as exceeding every other Book on that Subject, for Method and Perſpicuity, taking the whole Subject-Matter together. Whoſe Writings being truly claſſical, his Followers are but Imitators.*

The Rev. and ingenious Mr. William Weſt, *of* Exeter, *died* October 1, 1760, *aged* 53.

ERRORS *omitted to be corrected in the Second, printed in the Firſt, Edition.*

P. 12. L. 4. r. (multiplying by $\overline{4ax-4xx}^{\frac{1}{2}}$ and dividing by $\dot{x}$).

P. 35. L. penult. f. AD, *i. e. ae*, r. (from above) *that* AE is equal to the Fluxion of the Line AD, *i. e. ae*.

P. 67. L. 22. f. E*e*, r. F*e*.

Apology, *April* 20, 1761. After the Apology, in the *altered Edition*, r. "☞ In this *ſecond Edition* are a few Additions: But ſome Things in the "*former*, which the Editor finds to be erroneous, are here omitted. *May* 2, "1763."

⁂ The Meaning of which is, the Title, and alſo Apology Leaf, of the original Edition, are reprinted, the 2 Leaves of the 112 worthy Subſcribers for the Widow's Benefit, are omitted; Part of Page 77, concerning the Moon's Orbit, Pages 78, 79, 80, and Part of 81, containing the two new Propoſitions aforeſaid, in the Room of Mr. *Weſt's* two Propoſitions omitted in the *altered Edition.*

EMENDATIONS.

P. 2. L. 1. r. Point or Limit. L. 20. r. Quantities *by thoſe* of the *Beginning.*

P. 3. L. 20. r. to which connect with a *contrary Sign.* For if the Sign — be connected, when the *Denom.* is *negative,* it will be an *Error.*

P. 6. The Reaſon of the general Method, making the Fluxion of a Maximum or Minimum $= 0$, is better apprehended than what is ſubſtituted in a particular Caſe, for finding the *Maximum* or *Minimum,* when a *Rectangle,* which is but a Conſequence of the *general Method,* extending to all Caſes of *Maxima* and *Minima.*

P. 9. According to the *new Method* of Reaſoning is according to the *Conſequence* of the *general Method.*

As to what is ſaid, when x is increaſing then y is decreaſing, *i. e.* juſt as the *two Factors* of the Rectangle are expreſſed.—Therefore the Sum of the different Fluxions of one Side or Factor into the Fluxion of the other Side or Factor, when tranſpoſed to different Sides of an Equation, firſt $= 0$, will be affected with *contrary Signs.*

P. 18. If all Fluxions in themſelves are *equally poſitive* (*viz.* affirmative) *Quantities,* when x^x is a *Minimum,* then L. $x \times x$, is a *Minimum;* and by ſuch affirmative Argument L. $x : x :: \frac{\dot{x}}{x}$ poſitive : $\dot{x}$ poſitive. ∵ L. $x = 1$, an Error, (for L. $x = -1$) the Conſequence of the Common or this *new Way,* not reaching to all Caſes.

P. 25. Equivalent to $2 \times \left.\overline{\frac{b^2a^2-b^2x^2}{a^2}}\right|^{\frac{1}{2}} \times \overline{a+x}$ a *Maximum,* is $a^2-x^2 \times \overline{a+x}^2$ or $a-x \times \overline{a+x}^3$ a *Maximum.*

In *Fluxions.* $-2x\dot{x} \times \overline{a+x}^2$, $+2 \times \overline{a+x} \times \dot{x} \times \overline{a^2-x^2} = 0$. ÷ by $\dot{x} \times \overline{a+x}^2$, and $-2x + 2 \times \overline{a-x} = 0$, whence $x = \frac{1}{2}a$.

P. 26. Equivalent to $\overline{a+x} \times \frac{a^2b^2-b^2x^2}{aa}$, a *Max.* is $\overline{a+x} \times \overline{a^2-x^2}$, a *Maximum.* —— In Fluxions, $\overline{a+x} \times -2x\dot{x}$, $+ \overline{a^2-x^2} \times \dot{x} = 0$. ÷ by $\overline{a+x} \times \dot{x}$, and $-2x$, $+ \overline{a-x} = 0$, here $x = \frac{1}{3}a$. See both Mr. *Weſt's* Solutions by the *common* and alſo by the *new Way.*

N. B. *You may find the* Maxima, *or* Minima, *of Rectangles, by the Fluxions of their Logarithms* $= 0$.

For when $\overline{a-x} \times x$ is a *Maximum,* L. $a-x$ + L. x, a *Maximum.* Hence, $\frac{-\dot{x}}{a-x} + \frac{\dot{x}}{x} = 0$, or $\frac{-1}{a-x} + \frac{1}{x} = 0$. or $\frac{-x+a-x}{\overline{a-x} \times x} = 0$, where, $x = \frac{1}{2}a$.

matical Sciences, Truth appears moſt conſpicuous, and ſhines in its greateſt Luſtre: In other Sciences it is either ſelf-evident, and then it affords little Pleaſure to the Mind; or elſe it appears with ſo much *Obſcurity*, that *Falſhood* is often miſtaken inſtead of it. The *Evidence* for it is ſo *dim*, that it is only ſeen as in a *Miſt*; and Truth ſeen through ſuch a dull *Medium*, will hardly be known to be Truth; the Mind will be loſt in *Doubt* and *Obſcurity*, and will be unable to make any certain *Concluſion*. But, in the *Mathematics*, all their *Demonſtrations* are free from any *Obſcurity*, every Step has a clear and intuitive *Evidence*, and where that falls ſhort, the *Matter* is thrown out as not deſerving a Place among *mathematical* Truths.

The *Manner* whereby Truth is found out is by *Reaſoning*, which is performed by firſt laying down a Foundation, certain evident Principles, or ſuch as cannot be denied; and then proceeding from theſe by ſeveral *Steps* till they come at the *Concluſion*; which Steps are to be *linked* with each other, and laid in ſuch *Order*, that the Underſtanding may perceive their *Connexion* and *Agreement*; which being every where true and right, the *Concluſion* muſt *infallibly* be true: for all the Parts being locked together by Truth, the laſt *Reſult*, though never ſo long, muſt be equally true.

Thus *Mathematicians* from a few *plain* and *ſimple* Principles, and continued Chain of Reaſoning, proceed to the *Diſcovery* and *Demonſtration* of Truths that appear, at firſt Sight, beyond human *Capacity*. The Art of finding *Proofs*, and the admirable Methods they have invented for finding out and laying in Order thoſe intermediate Ideas that ſhew the Connexion of the ſeveral Steps of the *Proof*, or the ſeveral Links of the Chain of Reaſoning, is that which has carried them ſo far, and produced ſuch wonderful and unexpected Diſcoveries. In this Science there appears to be an inexhauſtible Fund in the ſeveral *Branches* thereof; any one of which a Man may purſue as far as he pleaſes, and ſtill improve his Knowledge farther and farther: And thus, by the Help of Truths already known, more and more may ſtill be found out *ad infinitum*.

When the Mind works on *mathematical Ideas*, it works ſecurely; which cannot be done in other *Things* ſo truly, becauſe one cannot keep ſo ſtrictly to the *Definitions*, or the Meaning of Words in other Subjects; where the *Ideas* are often confounded. But *Mathematicians* take Care not to confound theirs; for none ever miſtook the Idea of a *Square* for that of a *Circle*: — Therefore *mathematical Demonſtrations* are the moſt proper Means to cleanſe the Mind from *Errors*, and to give it a Reliſh of Truth, which is the natural Food and Nouriſhment of the Underſtanding.

Reaſoning, which is the Exerciſe of *Reaſon*, is beſt learnt from the *Example* and *Practice* of Mathematicians. It is certain that no Sort of human Knowledge can lay ſo juſt a Claim to an unſhaken Evidence and Certainty, or boaſt ſo great Strength of its Demonſtrations, or produce ſuch a Multitude of undeniable Truths as the *Mathematics*. All that beautiful *Analogy*, and that harmonious *Connexion* and *Conſiſtency* is quite loſt in other Sciences. Wherefore it is no Wonder that greater Improvements have been made in the *mathematic Sciences* than in all the Reſt put together. By following their Methods, a Habit of right Reaſoning is obtained by frequent Practice, like other Things, and the *Cauſe* why many People reaſon ſo badly is, for Want of Practice, due Attention, and Conſideration. They proceed in the *Track* which Chance has put them into, being ignorant of *true Science*, and of thoſe univerſal invariable Principles, upon which true Reaſoning depends; as is evident from the *many Inſtances* of falſe Reaſoning and Ignorance wherewith the Diſcourſes and Writings of Mankind abound, *&c.* — Which excellent Author, in ſeveral ſhining Pages, farther purſues the Thread of his Argument with admired *Perſpicuity* and *Preciſion*, through all the Modes and Uſes of his elaborate Subject. — To which we refer the Reader.

A PRIZE-ÆNIGMA, *by* I. Tarratt, *of* Epſom.

The Laurel, you know, is the Prize.

A Native *Perſian*, with true Merit fraught,
Sues now for *Honours* at the *Britiſh* Court:
Sue, did I ſay — ſay rather, I've Pretence
Honours to give, and Favours to diſpenſe.
Though mean my Parents, yet a People wiſe,
From ſmall Beginnings, ſee great States ariſe:
And *Politicians* ſhould inculcate this,
No Matter whence he comes, but what he is.
Should I relate the *Perils* I have run,
Time would elapſe ye of a Summer's Sun.
Perils by *Sea*, Perils by *Land* I've known,
Both of the *Torrid* and the *Frigid* Zone:
Theſe paſt — triumphant through the Streets I ride,
In Colours gaudy, as the *Peacock*'s Pride;
Again in *White*, pure Innocence to ſhew,
But dreſs'd in *Black*, I am, and make a *Beau*:
Like Magic-Wand, I in an Inſtant can
Of Country *Clodpole* make a *Gentleman*;
Step to *St. James*'s — ſee my *Figure* there,
I ſerve the *Coward*, *Cuck-ld*, or the *Peer*.
The glittering *Helmet* which the *Grecians* bore,
Some dignify'd, and ſome ignoble wore;
So I with *S——e* once enjoy'd a Place,
With *Byng* I ſail'd — but here I met Diſgrace:
Not ſo with *T-rr-l*, of exalted Fame,
Whoſe *Laurels* grace me: — Ladies tell my Name.

To the PALLADIUM AUTHOR.

DEMONSTRATION *and* CORRECTION *of the* ERROR *of the Propoſition in* Robertſon's Navigation, *(P.* 364, *Art.* 733.) "*On the Globe the Rhumb* "*Lines, oblique to the Meridian, are* Spirals, *which conſtantly approach the* " Poles, *but never meet them.*"

SIR,

IF it be granted that a *Point* moves *uniformly* along any *Rhumb* (cutting the Meridian Lines on a Globe at equal Angles) then the ſaid *Point* will alſo move *uniformly* towards the Pole, as has been demonſtrated over and over. (See *Ladies Diary*, 1739, P. 8.) From whence this obvious Conſequence muſt follow, that it will reach the Pole in a finite Time. For Mr. *Robertſon*, or any other Perſon, to deny which, is equivalent to denying, this PROPOSITION: *That a Body moving with a given Velocity will paſs over a given Space in a given Time.*

Men who diſpute the Truth of a *Rhumb Line*'s uniformly meeting the Poles in a finite Time, ſeem to have read little or Nothing of the higher *Geometry*, or the Nature of *Curve-Lines*; ſince there they would meet with Numbers of theſe Curves, eſpecially among the *Spiral* Kind, having very odd Properties. And the *Rhumb* is one of the *Spirals* of the *proportional* Kind, till it draws near the Poles, when it becomes the ſame as the *Logarithmic Spiral*; becauſe the Horizon then becomes a *Plane*.

But, as ſome, not uſed to *abſtract Reaſoning*, may think that this *Aſſertion* is embarraſſed with certain Difficulties, it is here conſidered a little farther.

Suppoſe a Ship ſailing, conſtantly, at a given Rate, on any *Rhumb*; a *Line* drawn through the Center of the Ship along the *Keel*, will be a *Tangent* to the proportional *Spiral* ſhe deſcribes. It is plain, as ſoon as the Ship's Center has arrived within 3 or 4 Feet of the *Pole*, that then the Pole will be within the Body of the Ship. *Let us ſee what will be the Conſequence.*

The Center of the Ship's *Keel* (*conſidered as a Point*) continues to move as before, and will make very quick Revolutions about the Pole, to continue the ſame uniform Motion with which ſhe ſet out and proceeded; and the *nearer* ſtill the Ship is to the Pole, the *quicker* the ſaid Revolutions will be; whereby the Ship will acquire a *very quick* Motion about her *Axis*, while ſhe does not ſtir, ſenſibly, out of her Place. And the nearer her Center is to the Pole, the quicker her *Gyrations* will be. And as her Center gets into the Pole, in a *finite Time*, the *Gyration*, or whirling round of the Ship, or of the Tangent to the Spiral her Center deſcribes, will, in that *finite Time*, paſs through *all the Degrees of Velocity to Infinity*. Therefore, the Ship will preſently (*in a known Time*) acquire an *infinite* Velocity about the Center. And of this there is no Wonder; for the *nearer* ſhe, or the progreſſive Point of her *Keel*'s Center, comes to the Pole, the nearer will ſhe, or that Point, make a Revolution about it. The *Time of making a Revolution being as the Diſtance from the Pole.* Whence it muſt follow, when ſhe, or the progreſſive Point, is in the Pole, and her Diſtance $= 0$, that the Time of a Revolution will be alſo $= 0$; that is, ſhe muſt *whirl or move infinitely ſwift about her Center*; having got into the Pole, in a *finite Time*, at the ſame uniform Rate of Motion; paſſing over *equal Diſtances in equal Times*.

Hence, you may ſee, that the Ship's progreſſive Motion terminates at laſt in a whirling Motion, in an *infinite Degree*, to continue the Rate, at ſo much *per* Hour, of uniform Motion in the progreſſive Point. And this will ſolve one *great Objection*, that thoſe of a contrary Sentiment have ſtuck at; for, ſay they, if the Ship arrive at the Pole, when it goes into it, *it muſt cut all the Meridians at the ſame Angle, which is impoſſible.* But it is ſo far from being *impoſſible*, that it is *actually true*: For at that Time the Ship having an infinite whirling Motion or Velocity, her *Keel* will cut all Meridians at the ſame Angle, at the ſame *Inſtant* of Time; becauſe (*her Motion being infinite*) there is *no Length* of Time required for one Revolution. If there were any, even the *ſmalleſt*, Time required for one Revolution, her Motion would not be infinite. Thus is the Ship moving uniformly at a certain Rate or Number of Miles *per* Hour in a Rhumb Line or Spiral, traced from her firſt ſetting out through her whole Progreſs into the Pole itſelf, in a *finite Time*; contrary to the Propoſition publiſhed in *Robertſon*'s *Navigation*, denying the Truth of the ſame.

Some may *object*, that the Ship can never acquire an *infinite Velocity round her Axis*; becauſe there muſt be an infinite Force required to do it. But this Velocity will be the *Conſequence of the firſt Suppoſition*; which Suppoſition is, that her *Way* (*or Direction of the Keel*) *always cuts the Meridians at the ſame Angle, at the ſame uniform Rate of Motion, or Number of Miles* per *Hour, continued.* Therefore if the Conſequence be impoſſible, the Suppoſition was abſurd. —

Hence, the Error of Mr. *Robertſon's Propoſition* is demonſtrated and corrected. (*See* Palladium 1764, *P.* 70, 71, 72.)

ANOTHER QUESTION.

IT would be a quite *different Queſtion* to aſk, *In what Time a Ship would arrive at the Pole, ſuppoſing ſhe cuts all Meridians at the ſame Angle, and moves through equal Degrees of Longitude in equal Times*; *or* (if you will) *makes her Revolutions round the Pole in equal Times, whereby her Motion would become ſlower and ſlower?* — The ANSWER to which would be, *that ſhe would never arrive at the Pole.* And perhaps ſome Objectors to the Spirals never meeting the Poles, have confounded theſe *different Caſes* together. Though the *firſt Propoſition,* or *Queſtion,* is but a ſpeculative Truth or an abſtract Curioſity in geometrical Reaſoning; yet, in *Practice,* a Ship deſcribing a *Spiral,* will get as eaſily under the Pole, as to any other Place; take but the *Impediment* away, which is the Ice.

When the *Ship,* or progreſſive Point, is arrived at the Pole, its Motion *terminates there,* and it can get no farther according to the Suppoſition of an uniform Motion; except by ſuppoſing a new and contrary Motion, in a given *Direction* with each Meridian, and Rate or Length of *Progreſſion,* in a given Time; for the Spiral, or Rhumb, to be uniformly generated from, inſtead of into, the *Pole.*

I ſhall ſend you ſome other new *Subjects in Navigation,* and farther Obſervations on *Robertſon's Navigation,* as Time and Opportunity ſuit: Who am,

Sir, your humble Servant,

ACADEMICUS.

REMARK *by the* AUTHOR.

The finite Lengths of the Rhumbs, *or* Spirals, *terminating in the Poles, compoſe of infinitely ſmall and other finite Revolutions, are* ſimilar *(in their finite Dimenſion to the ſame finite Areas or Solidities, of Triangles and Priſms, ſtanding on the ſam Baſe, in Length or Area, whoſe Vertices reſpectively terminate in the ſame diſtant parallel Line or Plane, though infinitely remote from the parallel Baſe (Line or Plan whereon they ſtand. Thus, the Area between the Aſſymptote and hyperbolic Curv never uniting, though infinitely extended, is alſo finite and determinate; as likew are the Areas and Solidities of many other infinite Curve-Spaces and tapering Solidi the Equations of whoſe generating curved Lines and Spaces are expreſſed.*

APOLOGY *for the Rev. Mr.* Weſt's *Firſt* EDITION *of* MATHEMATIC *altered into (what is called) the Second* EDITION, *ſuppoſed to the Reader's a that Author's Diſadvantage. Which* altered Edition *we were induced to recom mend.* (See Pal. 1764, P. 108.)

HAD the *Editor* introduced an *Apology* for, and *Connexion* to, Mr. *W* XX. PROPOSITION, erroneous but in *one Particular,* and retained that and t XXI. PROPOSITION, as demonſtrably true as any Propoſition in *Euclid,* addi (if he pleaſed) what he has done to the *Scholium* concerning the Moon's Orb and his own two new Propoſitions, inſtead of omitting Mr. *Weſt's* two origin *Propoſitions,* to introduce his own two only in the *altered Edition,* the Reader Mr. *Weſt's Mathematics* might then have judged for himſelf, as to that Autho Merit, in his INVENTION of a NEW SEA CHART, on a new Projectio (whoſe Deſign was, at leaſt, *laudable,*) failing but in *one Particular:* Whi was, in Mr. *Weſt's* having aſſerted that the *Rhumb Lines,* in the Projection his *Chart,* (contained in his XX. *Propoſition* in his unaltered Edition) are *ri*

Li

If $\overline{ax-xx}^{m}$ is a *Maximum*, then $m \times \overline{ax-xx} \times \overline{a-2x} \times \dot{x} = 0$. Hence, *univerſally*, let m be what it will, $a-2x=0$, and $x=\frac{1}{2}a$, dividing by $m \times \overline{ax-xx} \times \dot{x}$; but dividing by $m \times \overline{a-2x} \times \dot{x}$, then $ax-xx=0$, where $x=a$, when $\overline{ax-xx}^{m}$ is a *Minimum*, as is evident.

By the Rectangle, $\overline{a-x}^{m} \times x^{m}$ ($= \overline{ax-xx}^{m}$) a *Maximum*. —— Then, $m \times \overline{a-x}^{m-1} \times -\dot{x} \times x^{m} + mx^{m-1}\dot{x} \times \overline{a-x}^{m} = 0$. $\div$ by $m \times \overline{a-x}^{m-1} \times \dot{x}$, then $-x^{m} + x^{m-1} \times \overline{a-x} = 0$.

$\div$ by x^{m-1}, then $-x + \overline{a-x} = 0$, and $x=\frac{1}{2}a$; as before.

By the *new Way*, $\overline{a-x}^{m} : x^{m} :: m \times \overline{a-x}^{m-1} - \dot{x} ; mx^{m-1} - \dot{x}$ (changing the Sign of one of the Fluxions) $\therefore -\overline{a-x}^{m} \times mx^{m-1} = -x^{m} \times m \times \overline{a-x}^{m-1}$ (equivalent to the above Equation $=0$, by the general Method.)

In P. 31, $x^{\frac{1}{m}} - x^{\frac{1}{n}}$, a *Maximum*.

$\frac{1}{m}x^{\frac{1}{m}-1}\dot{x} - \frac{1}{n}x^{\frac{1}{n}-1}\dot{x} = 0$, or $\frac{1}{m}x^{\frac{1-m}{m}}\dot{x} = \frac{1}{n}x^{\frac{1-n}{n}}\dot{x}$, (*without farther Proof*) and $x = \frac{n}{m}\Big|^{\frac{mn}{m-n}} = \frac{m}{n}\Big|^{\frac{mn}{n-m}}$, where m muſt be greater than n.

If $m=1$, $n=\frac{1}{2}$, then $x=\frac{1}{2}$, by either Theorem, and the *Maximum* $=\frac{1}{4}$; being always between 0 and 1.

XX. PROPOSITION *in Mr.* Weſt's firſt Edition *of* MATHEMATICS.

‘ *If a rectangular Piece of Paper be turned into the Form of a right cylindrical Tube, and a Sphere be inſcribed therein, ſo as that the Axes of the Sphere and Cylinder do coincide, or that the Equator be the Line of* Contact *between the ſaid Tube and Sphere, and all the Points of the ſpheric Surface be projected, or tranſferred to the concave Surface of the Tube, by right Lines proceeding from the Center of the Sphere, and terminating in the ſaid concave Surface of the Tube: And then, if the Paper be opened and ſtretched upon a* Plane, *it will preſent a* Chart, *in which the* Meridians, Parallels *of* Latitude, *and* Rhumbs, [all but the *Rhumbs!*] *are all truly and geometrically projected in* right Lines.

DEMONSTRATION, *by Mr.* Weſt.

‘ With Regard to the *Meridians*, it is evident, that they are all thrown into *right Lines* in the *Tube*, being all parallel to the *Axis:* And as the *Parallels* of Latitude are all projected in Circles, perpendicular to the ſaid Meridian; ſo

' upon opening the *Tube*, as aforeſaid, they muſt neceſſarily become *right Lines* alſo.

' The only Thing therefore that requires a *Demonſtration*, is, that the *Rhumbs*, or *Loxodromics*, *become right Lines*, when the Paper *Tube* is extended as above. In order to this, let the *Eye* be ſuppoſed to be placed in the Center of the *Sphere*, when inſcribed in the Tube; then every *Rhumb* will appear to run round the Concave of the *Tube*, in the Manner of a *Bottle-ſkrew, in infinitum:* And the only Thing to be proved, is, that it keeps a parallel Direction to itſelf, every where; or, that it makes the ſame Angle with all the Meridians; or that the *projected Rhumb* makes the ſame Angle with the *projected Meridian*, as the true *Rhumb* makes with the true *Meridian* upon the Surface of the Sphere, [*a fine Diſcovery to the Purpoſe of Navigation if it had, as there is Merit in the failing Attempt.*] Theſe two Angles do apparently *coincide* with Regard to the Eye placed as aforeſaid; that is, they are *apparently* equal, to the Eye, in that Situation; and that they are alſo *really* equal is evident from this *Lemma, viz. That the* real *and* apparent *Bigneſs of any Angle are the ſame when the Eye is placed perpendicularly over either of its Sides; or when a Perpendicular, dropt from the Eye to the Plane of the Angle, falls upon either of its Sides.*— Now this is the very Caſe with Regard to both the Angles in the *Queſtion*; for the Perpendicular from the *Eye* falls on the *angular Point* of the Angle on the Sphere; and a Perpendicular from the *Eye* falls on the Meridian, which is on the Side of the Angle on the *Tube:* Conſequently, the *real* and *apparent* Bigneſs of each of thoſe Angles is the ſame; and *therefore as they appear equal, they are really ſo.* [Though not yet found out.] Q. E. D.

SCHOLIUM, *by Mr.* Weſt.

' It does not appear that *Mercator* or *Wright* ever thought of this Projection; [*did Mr.* Weſt *think of a truer?*] for the *Meridian Line* here is manifeſtly a Line of *Tangents*; whereas, in their Projection, it is a Collection of *Secants.* It may be added, that *Mercator*'s or *Wright*'s Chart is very *faulty* in the Bearing of Places; but in this it is as true and correct as upon the Globe itſelf: [*Pity but it had.*] I ſhall therefore preſume to ſay, that this *naval Planiſphere*, or Sea-Chart, is the moſt uſeful for the Purpoſes of Navigation ever yet invented, it being better than *Mercator*'s in one important Reſpect, and equal to it in all others.' — [*We wiſh that Mr.* Weſt *had lived long enough to have made his Words good.*]

' There are three Projections of the Sphere, (*ſays this Author,*) the *orthographic*, the *ſtereographic*, and the *nautical*. The two firſt of theſe are well known to *Mathematicians*; but the laſt was invented for the Purpoſes of Navigation; though hitherto a very *imperfect* and *defective* Invention. The *Errors* of the *plain* Chart are corrected, in a great Meaſure, by *Mercator*'s or *Wright*'s *Chart*; though the latter is not a *true* Projection of the Sphere in any Shape; nor indeed is it pretended to be ſuch by Mr. *Wright*, one of its Inventors, who repreſents it rather to be an Extenſion of the *ſpherical* Surface upon the inner Side of the concave Cylinder in which it is incloſed. Suppoſe (*e. g.*) the Globe to be ſo inſcribed in a cylindric Tube as to touch it every where in the Equator, and conſequently the *Axes* of the Globe and Cylinder to coincide; then ſuppoſe the Tube to be of hard and unyielding Subſtance, as of *Marble*, or the like, and the Globe to be of a ſoft Subſtance, as a *Bladder*, and to enlarge itſelf as that does, when blown, until the *globular Surface* becomes a *cylindrical one*, by applying itſelf to the internal, or concave, Surface of the Cylinder, both Ways towards each Pole. Mr. *Wright* ſuppoſes all the Parts

‘ of the *ſpherical* Surface to increaſe *uniformly* in this Extenſion; or ſo as that the Degrees of Longitude and Latitude, every where, ſhall ſtill continue to bear the ſame Proportion to each other, *i. e.* as *Radius* to *Secant* of Latitude: whereas, the *true Projection* (and which I apprehend will much better anſwer the Purpoſes of Navigation than either the plain Chart or Mr. *Wright's*) is this, (ſays Mr. *Weſt,*) *viz.* Let the Sphere be inſcribed in a *cylindric* Tube, as above; and let all the Parts of the *ſpheric* Surface be transferred to the concave cylindric Surface, by *right Lines* drawn from the Center of the Sphere. The Conſequence of which is, that, *when the Cylinder is opened, and ſpread upon a Plane, the Meridians, Parallels, and Loxodromics,* [*or Rhumbs,*] *will be all projected in right Lines, as in* Mercator's *or* Wright's *Chart, but in different Proportions.*

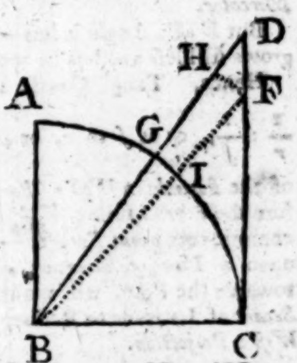
‘ And I take upon me to aſſert, [*how a Man may miſtake againſt the Judgment or Reputation of others!*] that this is the *firſt Chart,* or *Repreſentation* of the terraqueous Globe, ever yet invented, in which the *Meridians, Parallels,* and *Rhumbs,* are *juſtly* and *truly* projected in right Lines; for the latter cannot be ſo projected in *Mercator.*’

REMARK.

Which Declarations of Mr. *Weſt* being publiſhed cannot be recalled; and there is no Method of doing Juſtice to *Mercator* or *Wright's Chart,* approved by Dr. HALLEY's Judgment, but in as public an Acknowledgment of Mr. *Weſt's* propagated Error, to atone for the Liberties he has unjuſtly taken. At the ſame Time it may be ſeen in other Parts of Mr. *Weſt's Mathematics,* that he had much mathematical Merit, among ſome *trivial* Defects and *miſtaken Novelties*; agreeable to the Recommendation and general Character we gave of his Works in our preſent Year's *Palladium.* — *Though no Man has a Right to more Laurels than he ever won.*

XXI. *True* PROPOSITION *by Mr.* Weſt.

IF the Quadrant *of a Meridian* AC, viz. *from the* Pole *to the* Equator, *be projected on a Line of* Tangents, *as* CD, &c *for the Purpoſe of a naval Chart, (as in the foregoing* PROPOSITION,) *in which all the Parallels of Latitude are ſeverally equal to a great Circle, and to one another, I ſay, that the Increments of Latitude in that* Projection, *will be to the corresponding Increments of Longitude, in the duplicate Proportion of the ſaid Increments in* Mercator's *or* Wright's *Chart,* i. e. *the* duplicate *Proportion of the* Secant *to the* Radius. Quere *the Demonſtration.*



[N. B. BD *ſhould have been a* prickt *and* BF *a* full *Line, to make* IG *and* FD *correſpondent* Increments *of Longitude and Latitude, which are now repreſented* Decrements; *though anſwering the ſame End.*]

DEMONSTRATION, *by* Mr. Weſt.

LET the *pricked* Line BF be drawn infinitely near to the *Secant* BD; and let the Arch HF be concentric to GI; then GI will be equal to the *Increment* of Longitude (being the *Increment* of a great Circle) correſponding to FD the *Increment* of Latitude. But GI is to HF as *Radius* to *Secant,* and HF is to FD evidently in the ſame *Ratio,* (both from the *Similarity* of Triangles:) Conſequently, GI is to FD, as the Square of *Radius* to the Square of the *Secant.* Q. E. D.

DEMONSTRATION, *by the* Palladium Author.

PUT $r = \textit{Rad.}\ ſ = \textit{Secant}$, of an Arch.

$$\left.\begin{array}{l} \text{Then, } GI : HF :: (BG : BH)\ r : ſ \because GI \times ſ = HF \times r \\ \text{And, } HF : BD :: (BC : BF)\ r : ſ \because HF \times ſ = FD \times r \end{array}\right\} \textit{both by ſim. Triangles.}$$

Now multiply the two Equations, and $GI \times HF \times ſſ = FD \times HF \times rr$.

Or, $GI \times ſſ = FD \times rr$.

Hence, according to Mr. *Weſt*, as $GI : FD :: rr : ſſ$. Which *Propoſition* was ſtruck out of Mr. *Weſt's 1ſt Edition* as erroneous, and denied to be true by thoſe who miſtook the Demonſtration; though ſeen to be as demonſtrable as any *Propoſition* in *Euclid*.

If you multiply the *two* above Equations *croſs-ways*, $GI \times FD \times ſr = HF \times HF \times ſr$, whence, $GI \times FD = HF^2$: Or, $GI : HF :: HF : FD$. Whence HF is a *mean Proportional* between the Increments of Longitude and Latitude on *Weſt's Chart*.

N. B. IG is the *Increment* (or Arch) of Latitude equal to the *Increment* (or Arch) of Longitude, to the ſame great Circle, on the Globe. The laſt, or IG, is projected in a *right Line*, as is alſo FD, the correſpondent Increment of Latitude, in perpendicular Directions to each other, in *Weſt's Chart*.

By the *Author's Proof* of his *21ſt Prop.* (putting $r =$ Rad. $z =$ Arch Lat. $ſ =$ Secant Lat.) Then, as $rr : ſſ :: \dot{z}$, : Fluxion of his Meridian, $= \frac{ſſ}{rr}\dot{z}$: the Fluxion of *Mercator's* Meridian is known to be $\frac{ſ}{r}\dot{z}$; $\because$ the Fluxion of *Weſt's* Meridian to the Fluxion of *Mercator's* Meridian will be as $ſ\dot{z}$ to $r\dot{z}$. And ſuppoſing the Fluxion of Longitude to be $\dot{y}$ in both: Then, $\frac{\dot{y}}{ſ\dot{z}} =$ Flux. Tang. the Courſe in *Weſt*, and $\frac{\dot{y}}{r\dot{z}} =$ Flux. Tang. the Courſe in *Mercator*.

But *Weſt's* Angle is leſs — Therefore, in his Chart the Angle of the Curve grows ſtill leſs and leſs in approaching the Pole.

Hence, Tang. Courſe in *Mercator* to the Tang. Courſe in *Weſt*, is as $\frac{1}{r} : \frac{1}{ſ}$, or as $ſ$ to r, or as *Radius to Coſine of Latitude*, ſhewing the Deviation of the *Rhumbs* in *Weſt's Chart* from the *right Lines* in *Mercator's*. — And therefore thoſe who follow *Weſt's Chart* inſtead of *Mercator's*, in great Latitudes will commit very *great Errors*. — For, *Weſt* projecting the Meridians of his *Chart* upon a *Line of Tangents*, his *Rhumbs* cannot be *right Lines*; but, in going towards the Pole, will make the Angle of the Courſe *too little*, in Proportion as *Secant* of Latitude to *Radius*, or as *Radius* to *Coſ. Latitude*; being the Error of *Weſt's Projection*.

☞ Mr. *Weſt's* Friends and the candid Reader will excuſe us for the foregoing Liberties; being no more than the Liberty Mr. *Weſt* took with *Mercator's* and other Men's Judgments.

The *new Way*, according to Mr. *Weſt*, of determining the *Maxima* or *Minima* of *Rectangles*, is ſubordinate to, and derived from, the *general Method* of determining the *Maxima* and *Minima* of all variable *compound Quantities* whatſoever; to which the new Way, ſolving a Rectangle only, cannot reach.

For, if we conſider all *variable* compound Quantities, increaſing till they come to their *Limits*, and begin to decreaſe; or decreaſing till they come to their *Limits*, and begin to increaſe; there is Nothing *more evident* than that the Degree of Swiftneſs of Increaſe or Fluxion at thoſe *Limits*, at a *Maximum* in one Caſe, will be equal to *Nothing*. So likewiſe the Degree of Swiftneſs of Decreaſe, at the *Limits* thereof, at a *Minimum*, in the other Caſe, will evidently be equal to *Nothing*.

Whence it *will follow*, if the *Sum* or *Difference* of two *fluxional* Products (of each Side or Factor, multiplied into the Fluxion of the other, generating a *Rectangle)* be affected with *contrary* Signs on the ſame Side of an *Equation* $= 0$, when they are tranſpoſed to contrary Sides thereof, with the Sign of one of thoſe fluxional Products changed, they muſt needs then be *equal*.

Hence THIS RULE OF PROPORTION, for ſolving the *Maximum* and *Minimum* of any variable RECTANGLE.

As one Side or Factor, is to the other Side or Factor, ſo is the Fluxion of the firſt, to the Fluxion of the ſecond; obſerving to change the Sign of one of thoſe Fluxions.

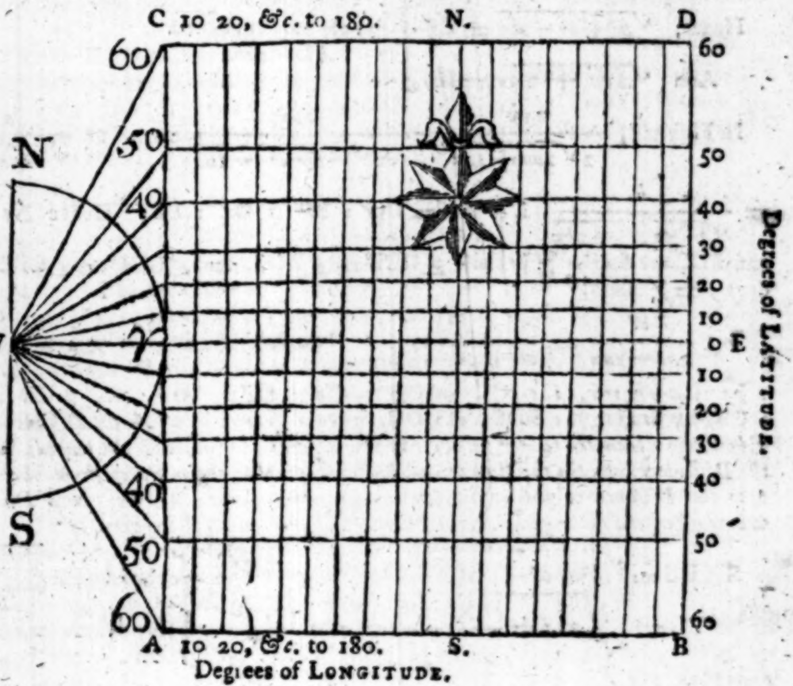
Whence reſults an Equation, giving the Value of the variable Quantity, at a *Maximum* or *Minimum*, required.

Thus explained, when $\overline{a-x} \times x$ a *Maximum*.

Then $a-x : x :: \dot{x}$ (Sign of one changed) : $\dot{x}$ (ſame.) Hence $\overline{a-x} \times \dot{x} = x\dot{x}$, whence $a-x = x$, and $x = \frac{1}{2}a$, required. See P.

He who to combat Error *ne'er was try'd,*
Seldom declares for Truth *on either Side.*

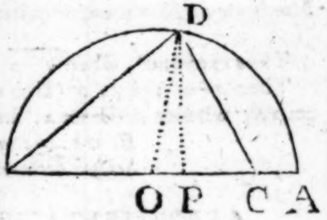
A REPRESENTATION *of Mr.* WEST'S *New* SEA-CHART.



Explanation. The Line AB equal to CD, divided into 180 equal Degrees of Longitude, is equal to half the Circumference of the Circle of an indefinite cylindric Tube, (opened to a Plane,) whoſe Radius is W*r*, having circumſcribed the Equator of the Earth both Ways in the Direction of its Poles, SN ; *r*N being a *Quadrant* of North, and *r*S a *Quadrant* of South Latitudes. — The Lines from *r*E to CD and AB are the Parallels on the Tangent-Line correſpondent to the Degrees of North and South Latitudes, as far as 60.

The Uſe of this Chart is like that of all others : But the *Rhumbs* on the ſame, being *Right-Lines*, deviate from thoſe *ſpiral* Rhumbs repreſented on the *concave Cylinder*, (circumſcribing the Globe as aforeſaid,) which being opened will ſhew them to be not *ſtrait*, but *curved*, Lines, *as before is proved*. But this *Chart* has nevertheleſs ſome Uſes in *Navigation* ſuperior to the *plain Chart*, though not equal to that of *Mercator* ; and may ſerve as an uſeful Hint for making farther Improvement in the Projection of the *ſpherical Surface, for the Purpoſes of Navigation.*

SOLUTION *to* XX. Proposition. *(See P* 7. *of this Supplement.) By the* Palladium-Author.



PUT BO $=$ OA $=$ OD $= a$; OC (the Diſt. of the given Point from the Center O) $= b$, $x =$ OP, required. By Property Circle $\sqrt{\overline{a+x}\times\overline{a-x}} = \sqrt{a^2-x^2} = DP = \sqrt{OD^2 - OP^2}$.

And $PC = b-x$. But $PC^2+PD^2=DC^2$.
$BP = a+x$. And $BP^2+PD^2=BD^2$.

$$\left.\begin{array}{r}\text{Hence, } \sqrt{b^2+a^2-2bx} = DC \\ \text{And } \sqrt{2aa+2ax} = BD\end{array}\right\}$$ whoſe Sum muſt be a *Maximum*.

In Fluxions, $\dfrac{2a\dot{x}}{2\sqrt{2aa+2ax}} - \dfrac{2b\dot{x}}{2\sqrt{b^2+x^2-2bx}} = 0$, or $\dfrac{a}{\sqrt{2aa-2ax}} = \dfrac{b}{\sqrt{b^2+a^2-2bx}}$, *i. e.* BO $=$ DO : BD :: OC : DC. Hence △s BOC and BDC are ſimilar ; becauſe ∠OCD $=$ ∠BCD, and ∠ODC $=$ ∠CBD evidently $=$ ∠BDO.

But $\dfrac{a^2}{2aa-2ax} = \dfrac{b^2}{b^2+a^2-2bx}$. Reduced, $x = \dfrac{\frac{1}{2}a}{b} \times \overline{a-b}$. $\because b : \frac{1}{2}a :: a-b : x$, *i. e.* OC : $\frac{1}{2}$OB :: CA : OP. Alſo, OC : CD :: CD : CB, by ſimilar △s BDC and DOC, proved above : *i. e. As the Diſtance of the given Point from the Center on the contrary Radius : is to half the Radius :: ſo is the Difference between the Radius and Diſtance of the given Point from the Center : to the Diſtance of the required Point from the Center, on the* given *Diameter, where a Perpendicular falls from the* required Point *in the Periphery.*

$$\left.\begin{array}{l}\text{But } DC = \sqrt{b^2+a^2-a\times\overline{a-b}} = b^{\frac{1}{2}} \times \overline{b+a}^{\frac{1}{2}} \\ BD = \sqrt{2aa+\dfrac{a^2\times\overline{a-b}}{b}} = a \times \dfrac{\overline{b+a}^{\frac{1}{2}}}{b^{\frac{1}{2}}}\end{array}\right\}$$ whoſe Sum $= \left.\dfrac{\overline{b+a}\,|^3}{b}\right|^{\frac{1}{2}}$ the *Maximum*, required.

N. B. From $x = \frac{a \times a - b}{2b}$ (above,) when $b = a$, then $x = 0$, or the Perpendicular falls in the Center. When $= \frac{1}{3}a$, then $x = \frac{a \times \overline{a - \frac{1}{3}a}}{\frac{2}{3}a} = a$, which is *impoſſible.* Conſequently, b or OC *muſt be greater than* $\frac{1}{3}$ *of* a. For, let $b = \frac{1}{2}a$, then $x = \frac{a \times \overline{a - \frac{1}{2}a}}{a} = \frac{1}{2}a$, properly. Let $b = \frac{1}{4}a$, then $x = \frac{a \times \overline{a - \frac{1}{4}a}}{\frac{1}{2}a} = 1\frac{1}{2}a$, *impoſſible.* Thus the *Limits* of this *ſpeculative Propoſition* are determined, *i. e.* when b is above $\frac{1}{3}a$.

☞ *Hence an eaſy geometrical Conſtruction follows from the above Proportions. — Without any Regard to* new Ways, *or equal Increaſe and Decreaſe of Increments and Decrements, depending on the above general Method.*

⁂ Thus have we given our candid and juſt Obſervations on the Rev. Mr. *Weſt*'s *Mathematics*; whoſe Merit and Miſtakes were firſt brought in *Queſtion* by the Compiler of the *Ladies Diary.* (*See Prize-Queſt.* 1764.)

As to Mr. *Weſt*'s ſecond Edition, we are of Opinion that no *Firſt Edition* corrected, with *Alterations* and *Additions,* ſhould be called a *Second Edition.* — Nor any *Introduction* to *Fluxions* or the *Mathematics,* or any *Eſſays, arithmetical* or *poetical,* whatſoever, *&c.* with *Alterations* and *Additions,* be called a *Second Edition.* — Since, a new *Title Page,* and a Sheet or two of new Matter, added to a *Firſt,* and *called a Second Edition,* is not a *true Propoſition* in Mathematics; and is therefore unworthy a true Mathematician. Becauſe it much reflects on the *Credit* and *Sale* of other Books of ſuperior Merit, (*Newton*'s, *Emerſon*'s, *&c.* not excepted,) found to be *much longer in coming to a real new Edition.* —Which *Artifice,* of *bibliopolian* and *fallacious* Invention, is commonly called *Puffing!* with Deſign to impoſe a *harmleſs Deception* on the Public, not quite unlike the *Cock-lane Ghoſt!* — *Magna eſt Veritas et prevalebit.* — *Nullius in Verba.*

The INSUFFICIENCY *of Mr.* HARRISON's WATCH, *or any other* TIME-PIECE, *for diſcovering the* LONGITUDE *at Sea. With enumerated* OBJECTIONS; *and an* EXAMINATION *of his* PROCEEDINGS *in Order to the* DISCOVERY *of the* LONGITUDE, (as publiſhed by his Approbation, in a Letter to the Right Hon. *****, Member of Parliament, 1763.)

Humbly addreſſed to the COMMISSIONERS *of the* LONGITUDE. *By the* PALLADIUM-AUTHOR.

THOUGH we ſincerely wiſh that every *ingenious* Artiſt may be properly rewarded for his *laudable* Endeavours to ſerve the PUBLIC, (and as ſuch we wiſh to ſee Mr. *Harriſon* duly rewarded for the Improvement of his *Time-Piece,*) yet we muſt and ever ſhall look upon a *Time-Piece,* by this or any orher *celebrated Artiſt,* ſo far from anſwering the *important End* propoſed, for which an *Act of Parliament* has provided three different *Rewards,* (*viz. Ten Thouſaud Pounds for diſcovering the Longitude to* 60 *geographical Miles, Fifteen Thouſand to* 45, *and Twenty Thouſand to* 30 *geographical Miles,*) that ſhould either of theſe Rewards happen to take Place, through a miſtaken Zeal for the Perfection of a Time-Piece, or a favourable Judgment on the Reſult of its Motion, (*Partiality being out of the Queſtion wherein the national Good is concerned,*) it would prevent the beſtowing the proper Reward upon the Perſon or Perſons, who ſhould afterwards diſcover the Longitude by a more *uſeful, practical, and leſs expenſive Method.*

As we only offer our humble Sentiments on the apprehended *Inſufficiency* of Mr. *Harriſon*'s Time Piece, while we pay a due Regard to the Improvement and Improver's Merit, *(but a greater Regard to the national Intereſt and Proſperity,)* we hope to be excuſed for enumerating the following *Objections*; and alſo for our Examination of Mr. *Harriſon*'s *Proceedings*, publiſhed, with his Approbation, by a Perſon of Letters; though neither an *Aſtronomer* or *Mathematician.*

The Diſcovery of the *Longitude* at Sea from a firſt Meridian (whether from *Greenwich* or elſewhere) being of ſuch Importance to Navigation, in the Preſervation of Ships and Lives, as to deſerve a public Reward, it muſt merit, at this or any other Time, the public Attention. And ſince we find there have ever appeared more *Pretenders* than Perſons of *real* Ability to diſcover the Longitude, whereby the *honourable Perſons* appointed to judge of the Methods propoſed for that *End*, are not only liable to be impoſed on by *ſpecious Pretences*; but may be induced to aſſign the Reward to *plauſible Inventions* only, (fruſtrating the Deſign of the *Longitude-Act*,) the following *Objections*, or *Doubts*, concerning the ſaid Time-Piece, (as inadequate or inſufficient for the Purpoſe propoſed,) may not be unworthy the public Notice.

ENUMERATED OBJECTIONS *and* QUERIES, *relating to Mr.* HARRISON'*s* WATCH, *or* TIME-PIECE.

1. IF the Changes of *Heat* and *Cold*, *Wet* and *Dry*, are provided for, yet the Changes produced in the Movement, by the Effect of *Gravitation*, will be *more* or *leſs* (it is apprehended) according to the Diſtances of the Ship from the *Equator*. For, the Earth's Velocity (affecting the Spring of a *Watch* as well as a *Pendulum*) is conſiderably greater on a Parallel near the Equator, than on a Parallel nearer to the Pole.

2. If the *Time-Piece* ſent to *Jamaica* in 1761, and arrived there in *January* 1762, loſt 24 *Seconds* of Time at *Portſmouth* in 9 Days incluſive, from *October* 28 to *November* 6, 1761, being at the Rate of 2 Seconds 66 Hundreds loſt *per* Day, the ſame *Time-Piece (it is apprehended)* ſhould have been farther tried in the Courſe of that Voyage; eſpecially on Mr. *Harriſon*'s Arrival at *Jamaica*, (where it appears that but *one* Obſervation of equal Altitudes was taken at *Port-Royal*, *January* 26, 1762,) in Order to aſcertain the *equal Loſing* of the ſaid *Time-Piece*, that it did go or not, at the ſaid Rate allowed for; *which never was proved by repeated Trials.* For Want of which *repeated Trials* of the equal Movement of this *Time-Piece*, the faſter or ſlower Movement thereof might, *probably*, ballance one another; inſtead of the *Time-piece* preſerving an *equal* Motion during the ſaid Voyage.

3. If this *Watch*, or *Time-piece*, before it was ſent abroad, had been duly regulated by Mr. *Harriſon*'s infallible *Clock*, or rather by the *fixed Stars* tranſitting the Meridian from Day to Day, effected by adjuſting the Pendulum-Spring (if the Time-piece goes as perfect as pretended) ſo as to make the *Loſing* or *Gaining* inſignificant for a Week; then no Occaſion had been to allow for an *uniform* Loſs (or Gain) *per* Day, in the *final* Reckoning; perplexing the Mariner's Account. If the Watch had been thus regulated, nearly according to *annual* mean Time, the true Difference of its going from that Time would at once have appeared, when the Equation of Time had been added or abated to or from the apparent Noon, in *equal* Time, by the *Watch*. By theſe Means the *Utility* or *Inutility* of this Time-piece would then, in a great Meaſure, have appeared; and the Suſ-

picion or Poſſibility of a *Legerdemain* had been removed, in taking a Number of equal Altitudes, from whence ſuch a mean Time at Noon reſulted as ſhould neareſt correſpond with the *Time-piece*, at returning off the Voyage to *Portſmouth* or elſewhere.

4. It is pretended that the *Watch* cannot be ſufficiently regulated to annual *equal Time*, but muſt go *faſter* or *ſlower* at a certain Rate of *Seconds*, in a certain Number of Days; to be reckoned for in the Account of the Number of Days in the Voyage. In this *eluded* Regulation, before the Voyage begun, the GRAND DELUSION of this *Time-piece* is ſuppoſed to lie. To which Deception its ſlower or faſter Motion, at different Times, ballancing one another, may farther contribute. Theſe Cauſes complicated with the different Effects of Gravity (ſuppoſing the Heat and Cold, Wet and Dry, and the Friction provided for) render it difficult to aſcertain the conſtant *Equality* of the Watch's Motion. For which End, repeated Obſervations of the Sun's equal *Altitudes* at different Diſtance of Days muſt be taken in ſeveral different Places; repeating the Obſervations in each Place.

5. Were Mr. *Harriſon* aſſured of the equal Movement of his *Time-piece*, (whether *faſter* or *ſlower* than annual mean Time,) his Scruples to compare the ſame with the *Greenwich* Clock at the Obſervatory, by which the aſtronomical Obſervations are made, would needs be leſs; ſince if his Time-piece was the more correct equal Movement, his Compariſon of it with the equable Motion of the fixed Stars tranſiting the Meridian, from Time to Time, would ſhew on which Side the Advantage lay. And as Mr. *Harriſon* is ſaid to have refuſed the Offer by our Aſtronomer Royal of trying the *equal Movement* of his *Time-piece* by the fixed Stars, it implies his own Doubt of the Accuracy.

6. If this *Time-piece* be not affected by the *Sea-Air*, *Oil* upon the Ballance, (of which ſome ſay none is uſed,) nor by violent *Agitation* in a Storm, nor by the *Gravity* at the different Parts of the Earth's Surface, nor by Heat, nor Cold, nor Wet nor Dry, nor *Friction*; nor the *Spring* ſubject to break on a Voyage, and every other Thing, Accident, or Caſualty to affect or impede its proper Uſe and Motion, to be ſufficiently provided againſt, (even againſt the Want of a Watch-Mender on Board,) ſo that the Time-piece ſhould go with all deſirable Preciſion and equal Accuracy, yet this Queſtion or Doubt will neceſſarily ariſe: *Whether another, or ſeveral other Watches, or Time-pieces, on the ſame Principles with the firſt, could with Certainty be made, to go equally true with the Time-piece to which the Reward by the Act for diſcovering the Longitude was aſſigned?*

8. If ſuch a Number of theſe correct *Time-pieces* could be furniſhed, as are ſufficient for the Uſe of his *Majeſty's Royal Navy*, it is ſuppoſed they would not anſwer the Purpoſe at a greater conſtant Expence to this Nation, than the Reward for the Diſcovery of the Longitude. For if the Price of ſuch Watches could be reduced to 100*l.* each, (which are now computed at 200*l.* the Value of each,) 100 ſuch for the Uſe of the *Navy* would be a ſtanding Expence of Ten Thouſand Pounds to this Nation, over and above the original Expence of the Diſcovery. And it is farther ſuppoſed that the *Merchant-Ships*, in general, not able to be at the Expence of ſuch Watches, could receive no Advantage from the Diſcovery of the Longitude in that perpetual *coſtly Manner*.

9. After ſuch an Expence to this Nation as *this Way* of diſcovering the Longitude would be, the *Mariner* muſt keep the ſame *good Look-out* in approaching Land, as he did before this Time-piece came in Uſe; in taking accurate Altitudes (depending on good Inſtruments, a clear Horizon, and his Abilities to uſe them) for obſerving the Latitude and Time where the Ship is got, on which depends the Knowledge of the *Difference* of Time between the Place of the Ship's

Departure (to which the Watch was ſet) and that of her preſent Place; conſtituting the *Difference of Longitude* required to be known. That ſince *one Part of the Diſcovery of the Longitude* by an equal-going *Time-piece* will be *of no Uſe* till the *other Part* (or the exact Time at the Ship) is nicely determined by celeſtial Obſervation, *it indicates that the whole Buſineſs of the Longitude ſhould depend entirely on celeſtial Obſervation.* For if the Ship's Time, from equal Altitudes of the Sun or Obſervation of the Altitudes of the fixed Stars, ſhould be found *defective,* the Error of *Longitude* to every Minute Error of Time (if the Watch ſhould happen to go equally) would be 15 *geographical* Miles. But if the *Watch* ſhould deviate 2 or 3 Minutes, making an Error of 30 or 45 geographical Miles, and a contrary Error happen in the Time obſerved at the Ship, then the Sum of the *Error of Longitude* might amount (at leaſt) to 4 Minutes, or 60 *geographical* Miles; by that Difference of 4 Minutes between the Time of the Watch and of the Ship.

10. Whether obſerving the Times of the Eclipſes of *Jupiter*'s firſt Satellite in *Irwin's Marine Chair,* to compare with their Times computed (or obſerved) under a *known Meridian,* and whether thoſe Eclipſes preſent themſelves often enough, or can be ſufficiently obſerved, at Sea, for the Purpoſe of the Longitude, the Obſervers lately ſent to the *Weſt Indies,* furniſhed with Mr. *Irwin*'s Chair, and all neceſſary and accurate Inſtruments for obſerving, (under the INSPECTION of a moſt ACCOMPLISHED JUDGE of the SUBJECT,) *muſt quickly diſcover.* — And had Mr. *Harriſon*'s TIME-PIECE been happily ordered to proceed the *Voyage* under the ſame UPRIGHT INSPECTION and ADEQUATE JUDGMENT in ASTRONOMY, there is no Doubt but the EQUALITY or INEQUALITY of its MOTION had been aſcertained (by true Methods) to a Degree of CERTAINTY and EXACTNESS; beyond the Power of *Partiality, Favour,* or *Self-Intereſt,* to controvert, againſt the SIDE OF TRUTH. And as there has never been any *Undertaking* like this laſt for the *Diſcovery of the Longitude,* with a Proſpect of Succeſs, by *able Obſervers* ſent under *judicious Inſpection,* ſo when the *important Diſcovery* is made, (which this Nation has Reaſon now more than ever to expect,) the *Glory of the Succeſs* will be reflected on that WISE COUNCIL who ordered the *Undertaking* to be carried on under the auſpicious Direction of ſo prudent, ſo capable, and enterprizing a CONDUCTOR!

Practical METHOD *of diſcovering the* LONGITUDE.

IF the Diſtance of the Moon's Edge from a *fixed Star,* or the *Sun's Edge,* as firſt propoſed for the Diſcovery of the Longitude by Dr. *Halley,* and ſince followed by the *French Aſtronomers* and *Navigators,* can be determined to 1 Minute or 2 of a Degree, the Moon's Place, and thence the *Longitude may be had to 60 geographical Miles, or leſs,* by eaſy *Tables,* or a *mechanical Conſtruction,* fit for the Practice of Mariners at Sea.

It has been objected to *this Method,* that a Star may be ſeen for 5 Minutes together on the *Moon's Edge,* and that no Obſervation of the Moon's Diſtance from a Star or the Sun can be taken near enough at Sea, [nor even by Land] to find the Moon's Place correct; nor conſequently the *Difference of Longitude.* But this Objection is anſwered, by obſerving with a *Teleſcope* by Night, to take off the confuſed Glare of the Moon, and only the Diſtance of the Sun from the Moon's Edge, by Day, without a Teleſcope. — Which Diſtance being well aſcertained, correct *Tables,* and a few Operations, will aſcertain the *Moon's Place,* and alſo the Longitude of the Ship. And this appears to be the only *Method* for general Practice at Sea, and bids faireſt for the *Premium* annexed to the proper *Diſcovery of the Longitude.*

⁂ *The Rev. Mr.* Maſkelyne *(one of the Obſervers lately ſent to the* Weſt Indies,) *and Mr.* Waddington, *of* London, *(ſent to obſerve the late Tranſit of* Venus,) *have both treated on theſe* Subjects, *of obſerving the* Longitude *and alſo* Latitude *at Sea by the Moon. — Which Methods may be much farther improved for the Eaſe and* Expedition *of the Mariner, by ready Tables, and mechanical Conſtruction.*

The Longitude *there made to begin from* Paris, *inſtead of* Greenwich, *unfitly ſhews more Regard to the Honour of the* French Tables *and* Nation *than to our own.*

IMPROPER DISTINCTIONS *in Mr.* HARRISON's *Computations of the Longitude by his Watch. See P.* 34, 35, 36, *of his* Pamphlet.

IN all theſe Examples of Computation, what Mr. *H.* or his Advocate calls *apparent Noon, for* 12, as taken from the Sun's equal Altitudes and Equation of Declination, ſhould be diſtinguiſhed by *equal* Time, by the Watch, of apparent Noon, for 12; becauſe his Equation of the Sun every where adds to, or ſubtracts from, this equal Time, by the Watch, alſo from the annual *mean for apparent* Time, or Noon. And for the ſame Reaſon, what he, or his *Advocate*, calls *mean Noon, for* 12, in the final Part of the Account, ſhould be denominated *apparent Noon*, for 12, *(not in equal Time by the Watch, becauſe the Sun's Equation is added to, or ſubtracted, from that Time.)* For if the *Watch* had been regulated to annual or diurnal mean Time, it would have ſhewed the *mean Time* correſpondent to *apparent Noon*, or 12, when the Sun croſſed the Meridian of the Place where the equal Altitudes of the Sun were taken; and the Equation of the Sun being then added or ſubtracted to or from that *mean Time*, would have been *preciſely* equal to 12. or *apparent Noon* itſelf. But, as the Watch is *ſuppoſed* to move *equally*, too ſlow or too faſt, of equal annnal mean Time, the *apparent Noon, or* 12, *as marked in equal Time by the Watch,* may be properly called *equal Time of apparent Noon*; as the *Reſult* of the Account may be called *apparent Noon*. And Noon (whether in Time, *equal, mean,* or *apparent)* being always put for 12, the Time by Account, deviating therefrom, will always be the *Difference of Longitude*, when the ſlower or faſter Motion of the *equal Time* by the Watch, than the *diurnal mean Time*, is allowed for; and alſo the Time allowed of the Watch ſet too ſlow or faſt in Regard to the *equal Time of the firſt apparent Noon*.

Therefore thoſe *Connoiſſeurs de Temps* miſtake, who aſſert, '*That a Watch may* '*be ſet to any Time and yet anſwer the Purpoſe of diſcovering the Difference of Lon*'*gitude, the ſame as if it had been ſet to correct mean Time.*' Which can only be true, by allowing for the Time the Watch was ſet too faſt or too ſlow of its firſt *equal Time, correſpondent to the firſt apparent Noon*; allowing alſo for its daily ſlower or faſter Motion than the annual or diurnal mean Time; to which all Obſervations, of apparent Noon, by the Sun's equal Altitudes, refer; when the Sun's Equation is likewiſe allowed for.

When the *Sun's Equation* of mean to *apparent* Time is + 16 Minutes, as in Mr. *Harriſon*'s Example, P. 34.

Then $12^h + 16^m$ is *apparent Time correſpondent to mean Noon, or* 12.
And $12^h - 16^m = 11 \quad 44$ is *mean Time correſpondent to apparent Noon, or* 12.

Diff. 32 Minutes, *double the Sun's Equation, the Time between mean and apparent Noon. — A new Diſtinction!*

☞ We alſo find, by Mr. *Harriſon*'s and other Examples, reducing the *equal Time (correſpondent to apparent Noon) to apparent Noon*, that if different Tables of the *Sun's Equation* be uſed, (whether in the *Royal Aſtronomer, Mayer's, Halley's, &c.)* the Reſult will be *very nearly* the ſame.

DIFFERENT METHODS *of examining the equal* Motion *of Mr.* Harriſon's *Watch.*

DR. *Halley*'s Method propoſed for examining the equal Motion of Mr. *Harriſon*'s Time-Keeper, ſeems to be void of reaſonable Objection, *viz.* ‘ *By ſending* ‘ *the Time-keeper on Board, to roll ſome Months in the* Downs, *where it would meet* ‘ *with all the various Agitations it could be liable to in the longeſt Voyage; with one* ‘ *of Mr.* Graham's *beſt Clocks, to be kept regulated in* Deal-Caſtle, *to examine the* ‘ *Going of Mr.* Harriſon's *Time-keeper by Signal. With a Thermometer to be kept* ‘ *in the Box with the Time-keeper, and the Air in the Box to be heated to the greateſt* ‘ *Degree of Heat known in* Jamaica, *for a certain Space of Time; and the greateſt* ‘ *Heights of this Thermometer on each Day of Compariſon of the Times by the Clock* ‘ *on Shore, and Watch on Board, to be noted.*’

But whether Mr. *H.* evaded this *Trial* of the equal Movement of his *Watch*, or *that* by the fixed Stars tranſiting the ſame Meridian, or by evading to go with the *aſtronomical Obſervators*, on Board the *Princeſs Louiſa*, to the *Weſt Indies*, Time muſt diſcover; and alſo whether his Watch will anſwer the End propoſed.

His Time-keeper in a former Voyage falling in with the Land, according to *Prediction*, can be no Proof of its equal Motion; becauſe the correct Longitudes of Places cannot be known, till the *Longitude is better diſcovered.* And the Fallibility of the Watch, making the *ſame Difference of Longitude* between *Portſmouth* and *Portroyal*, out and Home, according to Allowance of 2 Seconds, 66 Hundreds, loſt *per* Day, ſtrongly appears, in *no repeated Obſervations being made to aſcertain that equal Loſs:* And therefore the Deviation of this Time-piece from Equality of Motion might be compenſated by its different *Gettings* and *Loſings.* — *Its Equality of Motion being the only Thing in Queſtion to be proved.*

Mr. HARRISON'S, *or his* Advocate's, OBJECTIONS *anſwered.*

THE *Objection* to the *Error* (now under Proof by Obſervers ſent to the *Weſt Indies*) of 2 Minutes Difference of Time, in different Obſervers obſerving the ſame *Eclipſes* of *Jupiter's Satellites*, at the ſame Time, can have no Force; becauſe 2 Minutes Error in Time would be but half a Degree Error in the Longitude, or 30 *geographical* Miles. And if there were 3 Minutes Error in Obſervation it would be but 45 *geographical* Miles Error in Longitude, coming within the *Reward*; by a much cheaper and *more practical* Method, for the Benefit of all Shipping in general, than that by the *enormous Expence* of a *Time-keeper* to be provided for every Ship. Notwithſtanding which *Proviſion* for finding *one Part* of the Longitude, namely, the *Time at the Place of Departure*, other Inſtruments muſt be alſo provided for taking correct *Altitudes*, *Diſtances*, *&c.* to find the *other Part of the Longitude, or exact Time at the Ship*; whereas a few more Inſtruments *(of but ſmall Expence)* added, might ſerve for the *whole Purpoſe.*

The other Parts of Mr. *Harriſon*'s Longitude-Pamphlet conſiſt of *Quotations*, *Recitals*, *Repetitions*, and *Recapitulations*, of his Proceedings, to *little or no Purpoſe.* In ſome of which Matters, the Facts, as related, are diſputed on very good perſonal Authority, beſides *that* depending on Reaſon and Judgement. Some of which are, (P. 7.) ‘ *His Clock going not to err above a Second per Month* ‘ *for ten Years together*;’ [*Monſtrum horrendum!*] which is nearer by many Seconds [*Minutes we might ſay*] than the *niceſt* Obſervations of the Heavens can determine. — *The Particulars of his equal Altitudes not ſet down to be judged of, nor the equal Motion of his Time-piece proved*, are other Objections. *And the vain* Boaſts, Signatures, *and* Pretenſions, *ſerving only to ſhew the craving Deſire of obtaining the Longitude-Premium to be more predominant in ſome Men, than the* Glory, Merit, *and* Utility, *of making the* grand Discovery!

Here follow

New ASTRONOMICAL TABLES, *for correctly computing the* TIMES *of* ECLIPSES *of the* SUN *and* MOON, *and of all* New *and* Full MOONS, *for ever, ſince* Creation.

[21] TABLE I. Mean TIMES of the firſt *Mean New Moon* in *January*, from 1700 to 1800, ſince *Chriſt*, O. S. With the Places of the Sun and Moon's mean Anomalies, and the Sun's mean Diſtance from the Moon's *Node* aſcending, correſpondent. For expeditiouſly finding the *Orbit* and alſo *Ecliptic* N. and F. Moons, in Eclipses, and at other *Conjunctions* and *Oppoſitions*.

Yrs. of Chriſt.	Time of 1ſt M. N. Moon in Jan.				Place of the Sun's mean Anomaly.				Place of Moon's mean Anomaly.				Diſt. of the Sun fr. Moon's Node.			
1700	9^{d}	14^{h}	42^{m}	44	6^{s}	21°	43′	53	0^{s}	0°	52′	40	4^{s}	13°	10′	32
1	27	12	15	23	7	10	6	5	11	6	29	47	4	21	53	35
2	16	21	4	0	6	29	21	56	9	16	17	52	5	29	56	22
3	6	5	52	37	6	18	37	48	7	26	5	57	6	7	59	9
1704	25	3	25	16	7	6	59	59	7	1	43	3	7	16	42	10
5	13	12	13	53	6	26	15	50	5	11	31	8	7	24	44	57
6	2	21	2	30	6	15	31	4	3	21	19	13	8	2	47	44
7	21	18	35	9	7	3	53	52	2	26	56	19	9	11	30	45
1708	11	3	23	46	6	23	9	43	1	6	44	24	9	19	33	32
9	29	0	56	26	7	11	31	55	0	12	21	30	10	28	16	34
10	18	9	45	2	7	0	47	46	10	22	9	35	11	6	19	21
11	7	18	33	39	6	20	3	38	9	1	57	40	11	14	22	9
1712	26	6	6	18	7	8	25	48	8	7	34	46	0	23	5	10
13	15	0	54	55	6	27	41	40	6	17	22	51	1	1	7	56
14	4	9	43	32	6	16	57	30	4	27	10	56	1	9	10	44
15	23	7	16	11	7	5	19	43	4	2	48	2	2	17	53	44
1716	12	16	4	48	6	24	35	33	2	12	36	7	2	25	56	32
17	1	0	53	30	6	13	51	26	0	22	24	12	3	3	59	20
18	19	22	26	4	7	2	13	37	11	28	1	18	4	12	42	20
19	9	7	14	41	6	21	29	28	10	7	49	23	4	20	45	8
1720	28	4	47	20	7	9	51	39	9	13	26	29	5	29	28	9
21	16	13	35	57	6	29	7	31	7	23	14	34	6	7	30	57
22	5	22	24	33	6	18	23	22	6	3	2	39	6	15	33	43
23	24	19	57	13	7	6	45	33	5	8	39	45	7	24	16	44
1724	14	4	45	50	6	26	1	24	3	18	27	50	8	2	19	31
25	2	13	34	26	6	15	7	15	1	28	15	55	8	10	22	20
26	21	11	7	6	7	3	39	26	1	3	58	1	9	19	5	20
27	10	19	55	43	6	22	55	19	11	13	41	6	9	27	8	7
1728	0	4	44	19	6	12	11	10	9	23	29	12	10	5	10	54
29	18	2	16	59	7	0	33	21	8	29	6	17	11	13	53	56
30	7	11	5	35	6	19	49	21	7	8	54	22	11	21	56	42
31	26	8	38	15	7	8	11	23	6	14	31	28	1	0	39	44
1732	15	17	26	52	6	27	27	13	4	24	19	33	1	8	42	31
33	4	2	15	28	6	16	43	5	3	4	7	38	1	16	45	19
34	22	23	48	8	7	5	5	17	2	9	44	44	1	25	28	20
35	12	8	36	44	6	24	21	8	0	19	32	49	3	3	31	7
1736	1	17	25	21	6	13	36	59	10	29	20	54	3	11	33	54
37	19	14	58	1	7	1	59	10	10	4	58	0	4	20	16	56
38	8	23	46	37	6	21	15	1	8	14	46	5	4	28	19	43
39	27	21	19	17	7	9	37	12	7	20	23	11	6	7	2	44
1740	17	6	6	54	6	28	53	4	6	0	11	16	6	15	5	31
41	5	14	56	30	6	18	8	56	4	9	59	22	6	23	8	19
42	24	12	29	10	7	6	31	7	3	15	36	27	8	1	51	20
43	13	21	17	46	6	25	46	58	1	25	24	32	8	9	54	7
1744	3	6	6	23	6	15	2	49	0	5	12	37	8	17	56	55
45	21	3	39	3	7	3	25	1	11	10	49	43	9	26	39	56
46	10	12	27	39	6	22	40	52	9	20	37	48	10	4	42	43
47	29	10	0	19	7	11	3	3	8	26	14	54	11	13	25	44
1748	18	18	48	55	7	0	18	54	7	6	2	59	11	21	28	31
49	7	3	37	32	6	11	34	45	5	15	51	4	11	29	31	18
50	26	1	10	12	7	7	56	56	4	21	28	10	1	8	14	19
51	15	9	58	48	6	27	12	48	3	1	16	15	1	16	7	6

[22] TABLE I. continued. Mean TIMES of the firſt *Mean New Moon* in *Jan* fr. 1700 to 1800, ſince *Ch.* O. S. With the Places of the Sun and Moon's mean Anomalies, and the Sun's mean Diſtance from the Moon's *Node* aſcending, correſpondent. For expeditiouſly finding the *Orbit* and alſo *Ecliptic* N. and F. Moons, in Eclipses, and at other *Conjunctions* and *Oppoſitions*

Yrs. of Chriſt.	Time of 1ſt N. Moon in Jan.				Place of the Sun's mean Anomaly.				Place of Moon's mean Anomaly.				Diſt. of the Sun fr. Moon's Node.			
1752	4^d	18^h	47^m	25	6^s	16°	28′	39	1^s	11°	4′	20	1^s	24°	19′	53
53	22	16	20	4	7	4	50	50	0	16	41	26	3	3	2	55
54	12	1	8	41	6	24	6	41	10	26	29	31	3	11	5	42
55	1	9	57	17	6	13	22	32	9	6	17	36	3	19	8	29
1756	20	7	29	57	7	1	44	44	8	11	54	42	4	27	51	30
57	8	16	18	34	6	21	0	36	6	21	42	48	3	5	54	18
58	27	13	51	14	7	9	22	47	5	27	19	54	6	14	37	19
59	16	22	39	50	6	28	38	38	4	7	7	59	6	22	40	6
1760	6	7	28	27	6	17	54	29	2	16	56	4	7	0	42	53
61	24	5	1	6	7	6	16	40	1	22	33	10	8	9	25	54
62	13	13	49	43	6	25	32	32	0	2	21	14	8	17	28	41
63	2	22	38	20	6	14	48	23	10	12	9	19	8	25	31	28
1764	21	20	10	59	7	3	10	34	9	17	46	25	10	4	14	29
65	10	4	59	36	6	22	26	26	7	27	34	31	10	12	17	17
66	29	2	34	15	7	10	48	37	7	3	11	37	11	21	0	19
67	18	11	20	52	7	0	4	28	5	12	59	42	11	29	3	6
1768	7	20	9	29	6	19	20	20	3	22	47	47	0	7	5	53
69	25	17	42	8	7	7	42	30	2	28	24	53	1	15	48	54
70	15	2	30	45	6	26	58	21	1	8	12	58	1	23	51	41
71	4	11	19	21	6	16	14	12	11	18	1	3	2	1	54	28
1772	23	8	52	1	7	4	36	23	10	23	38	9	3	10	37	29
73	11	17	40	38	6	23	52	15	9	3	26	14	3	18	40	17
74	1	2	29	14	6	13	8	8	7	13	14	19	3	26	43	5
75	20	0	1	54	7	1	30	19	6	18	51	25	5	5	26	6
1776	9	8	50	31	6	20	46	10	4	28	39	30	5	13	28	53
77	27	6	23	10	7	9	8	20	4	4	16	36	6	22	11	54
78	16	15	11	47	6	28	24	11	2	14	4	41	7	0	14	41
79	6	0	0	23	6	17	40	2	0	23	52	46	7	8	17	28
1780	14	21	33	3	7	6	2	14	11	29	29	52	8	17	0	19
81	13	6	21	40	6	25	18	6	10	9	17	57	8	25	3	16
82	2	15	10	16	6	13	33	56	8	19	6	1	9	3	6	3
83	21	12	42	56	7	2	56	7	7	24	43	7	10	11	49	4
1784	10	21	31	32	6	22	11	58	6	4	31	12	10	19	51	51
85	28	19	4	12	7	10	34	10	5	10	8	18	11	28	34	53
86	18	3	52	49	6	29	50	2	3	19	56	23	0	6	37	40
87	7	12	41	25	6	19	5	53	1	29	44	29	0	14	40	27
1788	26	10	14	5	7	7	28	4	1	5	21	34	1	23	23	29
89	14	19	2	42	6	26	43	55	11	15	9	40	2	1	26	16
90	4	3	51	18	6	15	59	46	9	24	57	45	2	9	29	3
91	23	1	23	58	7	4	21	57	9	0	34	50	3	18	12	5
1792	12	10	12	34	6	23	37	49	7	10	22	56	3	26	14	52
93	0	19	1	11	6	12	53	41	5	20	11	1	4	4	17	40
94	19	16	33	51	7	1	15	52	4	25	48	6	5	13	0	41
95	9	1	22	27	6	20	31	43	3	5	36	12	5	21	3	28
1796	27	22	55	7	7	8	53	54	2	11	13	17	6	29	46	29
97	16	7	43	43	6	26	9	44	0	21	1	23	7	7	49	16
98	5	16	32	20	6	17	25	36	11	0	49	28	7	15	52	3
99	24	14	5	0	7	5	47	47	10	6	26	34	8	24	35	5
1800	13	22	53	36	6	25	3	38	8	16	14	39	9	2	37	52

24

The *Computer* muſt reduce New to Old Style, and having obtained his Anſwer O. S. muſt reduce it to N. S. again, for more Certainty of Computation.

of ☽ to ☉, next after *Jul. Centuries* completed.

Synodic Mths.	Julian Centur.	Mot. N. ☽ after Jul. Cen. comp.	Mot. of Sun's mean Anomaly.	Mot. of Moon's mean Anomaly.	Mot. ☉ fr. ☽'s North Node.
1237	100	$4^d 8^h 10^m 52^s$	$0^s\ 3^\circ 19' 44$	$8^s 15^\circ 23' 59$	$4^s 19^\circ 27' 17$
2474	200	8 16 21 45	0 6 39 27	5 0 43 58	9 8 54 35
3711	300	13 0 32 37	0 9 59 13	1 16 5 57	1 28 21 52
4948	400	17 8 43 29	0 13 18 58	10 1 27 56	6 17 49 10
6185	500	21 16 54 22	0 16 38 42	6 16 49 54	11 7 16 27
7422	600	26 1 5 14	0 19 58 27	3 2 11 53	3 26 43 45
8658	700	0 20 32 3	11 24 11 52	10 21 44 52	7 15 30 48
9895	800	5 4 42 56	11 27 31 37	7 7 6 51	0 4 58 6
11132	900	9 12 53 48	0 0 51 21	3 22 28 50	4 24 25 23
12369	1000	13 21 4 40	0 4 11 6	0 7 50 49	9 13 52 40
13606	1100	18 5 15 33	0 7 30 50	8 23 12 48	2 3 19 58
14843	1200	22 13 26 25	0 10 50 35	5 8 34 47	6 22 47 15
16080	1300	26 21 37 17	0 14 10 19	1 23 56 46	11 12 14 33
17316	1400	1 17 4 6	11 18 23 44	9 13 29 44	3 1 1 36
18553	1500	6 1 14 59	11 21 43 29	5 28 51 43	7 20 28 54
19790	1600	10 9 25 51	11 25 3 13	2 14 13 42	0 9 56 11
21027	1700	14 17 36 44	11 28 22 58	10 29 35 41	4 29 23 28
22264	1800	19 1 47 36	0 1 42 42	7 14 57 40	9 18 50 46
23501	1900	23 9 58 28	0 5 2 27	4 0 19 39	2 8 18 3
24738	2000	27 18 9 21	0 8 22 11	0 15 41 38	6 27 45 21
25974	2100	2 13 36 10	11 12 35 36	8 5 14 35	10 16 32 24
27211	2200	6 21 47 2	11 15 55 20	4 20 36 34	3 5 59 41
28448	2300	11 5 57 54	11 19 15 5	1 5 58 33	7 25 26 59
29685	2400	15 14 8 47	11 22 34 49	9 21 20 32	0 14 54 16
30922	2500	19 22 19 39	11 25 54 34	6 6 42 31	5 4 21 34
32159	2600	24 6 30 31	11 29 14 18	2 22 4 29	9 23 48 51
33396	2700	28 14 41 24	0 2 34 3	11 7 26 28	2 13 16 9
34632	2800	3 10 8 13	11 6 47 28	6 26 59 27	6 2 3 12
35869	2900	7 18 19 5	11 10 7 12	3 12 21 26	10 21 30 29
37106	3000	12 2 29 57	11 13 26 57	11 27 43 25	3 10 57 47
38343	3100	16 10 40 50	11 16 46 41	8 13 5 24	8 0 25 4
39580	3200	20 18 51 42	11 20 6 26	4 28 27 23	9 19 52 22

ECLIPSE-PERIODS, or Revolutions of the MOON to the SUN.

Synodic Mths.	Pers in Jul. Yrs. & Parts.		Mot. ☉ m. An.	Mot. ☽ m. An.	☉ fr. ☽'s N. ☊.
	Ju. Yrs	d h m s	s ° ' "	s ° ' "	s ° ' "
*Pl.*P 111	8	355 21 29 38	11 20 41 42	11 15 39 48	5 14 25 47
1. 223	18	11 7 43 20	9 10 29 42	11 27 8 37	11 29 31 48
235	19	0 16 32 56	11 29 45 33	10 6 56 42	0 7 34 35
251	20	107 4 16 45	3 15 26 42	0 0 0 49	4 18 13 18
270	21	303 6 13 43	9 28 16 49	4 10 31 58	0 1 2 42
364	29	157 3 14 30	5 4 21 3	1 7 18 39	0 4 4 32
2. 446	36	21 15 26 40	0 20 59 24	11 24 17 14	11 29 3 35
534	43	64 8 3 8	2 2 15 42	3 15 9 53	5 28 4 2
587	47	168 10 57 50	5 14 50 45	1 4 27 15	0 3 36 19
3. 669	54	32 23 10 0	1 1 29 6	11 21 25 51	11 28 35 23
767	62	4 23 6 59	0 3 48 38	0 1 28 34	4 4 18 8
810	65	178 18 41 10	5 25 20 27	0 1 35 53	0 3 8 7
4. 892	72	43 6 53 20	1 11 58 48	11 18 34 28	11 28 7 10
980	79	85 23 29 49	2 23 15 7	3 10 27 8	5 27 7 36
5. 1115	90	54 14 36 40	1 22 28 30	11 15 43 5	11 27 38 58
1203	97	96 7 13 9	3 3 45 50	3 7 35 43	5 26 30 24
6. 1338	108	65 22 20 0	2 2 58 12	11 12 51 42	11 27 10 45

unat.			Sign ☉ M. An.	Sign ☽ M. An.	Sign ☉ à ☊.
1	0	29^d,5305908511	,9701786292	,8605595917	1,02235124
716	57	$324^d 21^h 40^m 23^s$	$10^s 19^\circ 26' 13''$	$4^s 4^\circ 49' 12''$	$0^s 0^\circ 6' 16''$

N. B. Other *Eclipſe Periods* may be compounded from the *above Periods*.

TABLE III. Number of DAYS in the *Monthly* REVOLUTIONS of the MOON to the SUN, from *January*. With the Motion of the SUN and MOON's mean Anomalies, and SUN from the NODE.

Numb. of Days.	Mths.	Add a Day to Jan, N. Moon.				Mot. of Sun's M. Anomaly.				Mot. of Moon's M. Anomaly.				Mot. Sun fr. ☽'s Node.			
		d	h	m	s	s	°	′	″	s	°	′	″	s	°	′	″
29	Jan.	29	12	44	3	0	29	6	19	0	25	49	0	1	0	40	14
59	Feb.	28	1	28	6	1	28	12	39	1	21	38	1	2	1	20	28
88	Mar	29	14	12	9	2	27	18	58	2	17	27	1	3	2	0	42
118	Apr.	28	2	56	12	3	26	25	17	3	13	16	2	4	2	40	56
147	May	27	15	40	15	4	25	31	37	4	9	5	2	5	3	21	10
177	June	26	4	24	18	5	24	37	56	5	4	54	3	6	4	1	24
206	July	25	17	8	21	6	23	44	15	6	0	43	3	7	4	41	38
236	Aug.	24	5	52	24	7	22	50	34	6	26	32	3	8	5	21	51
265	Sept.	22	18	36	27	8	21	56	53	7	22	21	4	9	6	2	5
295	Oct.	22	7	20	30	9	21	3	13	8	18	10	4	10	6	42	19
324	Nov.	20	20	4	34	10	20	9	32	9	13	59	5	11	7	22	33
354	Dec.	20	8	48	37	11	19	15	51	10	9	48	5	0	8	2	47
Half Revol.		14	18	22	2	0	14	33	10	0	12	54	30	0	15	20	7

N. B. In Leap-year take out *one Day leſs* after *February* than the tabular No. But take out for the Mot. of the *Sun* and *Moon's Anom.* and ⊙à☊ as they ſtand. When the *New Moon* in *January* is above 15, ſubtract ½ Revolution for the *Full Moon*, or add ½ Revolution for the *Full*, when *Jan.* New Moon is under the 15th Day. — Obſerve the ſame for other Months.

TABLE of Mean *Lunations*, according to the *Moon* from the *Sun's Motion*, in the *Royal Aſtronomer*.

Numb. Lunat.	d	h	m	s	th	Numb. Lunat.	d	h	m	s	th
1	29	12	44	3	3	900	26577	12	45	44	35
2	59	1	28	6	6	1000	29530	14	10	49	32
3	88	14	12	9	9	2000	59061	4	21	39	4
5	118	2	56	12	12	3000	88591	18	32	28	36
4	147	15	40	15	15	4000	118122	8	43	18	8
6	177	4	24	18	18	5000	147652	22	54	7	40
7	206	17	8	21	21	6000	177183	13	4	57	12
8	236	5	52	24	24	7000	206714	3	15	46	44
9	265	18	36	27	27	8000	236244	17	26	36	16
10	295	7	20	30	30	9000	265775	7	37	25	48
20	590	14	41	0	59	10000	295305	21	48	15	20
30	885	22	1	31	29	20000	590611	19	36	30	40
40	1181	5	22	1	59	30000	885917	17	24	46	0
50	1476	12	42	32	29	40000	1181223	15	13	1	20
60	1771	20	3	2	58	50000	1476529	13	1	16	40
70	2069	3	23	33	28	60000	1771835	10	49	32	0
80	2362	10	44	3	58	70000	2067141	8	37	47	20
90	2657	18	4	34	27	80000	2362447	6	25	2	40
100	2653	1	25	4	57	90000	2657753	4	14	18	0
200	5906	2	50	9	54	100000	2953059	2	2	33	20
300	8859	4	15	14	51	200000	5906118	4	5	6	40
400	11812	5	40	19	49						
500	14765	7	5	24	46		29d 15305908911				
600	17718	8	30	29	43		29d 12h 44m 3s 2th 58f0				
700	20671	9	55	34	40		&c.				
800	23624	11	20	39	38		See Royal Aſt. P. 121.				

See Examples *of the Uſe of theſe* Tables *farther on.* *Correcting the Errors & Examples of computing antient Eclipſes, and alſo New and Full Moons, in a half Crown aſtronomical Pamphlet, of 63 inconſiſtent Pages.*

See *omnes Tabulæ Furguſoniæ perpetuæ blunderanæ, à conſpicuo Authore, F. R. S. non obſcuro quackero et hodgepodgero Aſtronomo.* (See last Advertiſement, in *Daily Advertiſer*, *Feb.* 11, 1764.

TABLE IV. EQUATION of the MOON's mean Anomaly.

Argument. Sun's mean Anomaly.

Sun's m. An.	Sig. 0.	Sig. 1.	Sig. 2.	Sig. 3.	Sig. 4.	Sig. 5.	Sun's m. An.
	—	—	—	—	—	—	
0°	0° 0′ 0″	0°47′ 3″	1°22′ 7″	1°35′49″	1°23′52″	0°48′49″	30°
1	0 1 39	0 48 29	1 22 57	1 35 50	1 23 2	0 47 20	29
2	0 3 17	0 49 54	1 23 46	1 35 49	1 22 11	0 45 50	28
3	0 4 56	0 51 17	1 24 41	1 35 47	1 21 18	0 44 19	27
4	0 6 34	0 52 40	1 25 20	1 35 44	1 20 24	0 42 48	26
5	0 8 12	0 54 2	1 26 4	1 35 38	1 19 29	0 41 16	25
6	0 9 49	0 55 29	1 26 47	1 35 30	1 18 30	0 39 44	24
7	0 11 27	0 56 44	1 27 28	1 35 21	1 17 30	0 38 10	23
8	0 13 5	0 58 3	1 28 9	1 35 10	1 16 30	0 36 36	22
9	0 14 41	0 59 22	1 28 47	1 34 56	1 15 28	0 35 1	21
10	0 16 18	1 0 17	1 29 24	1 34 43	1 14 25	0 33 25	20
11	0 17 55	1 1 53	1 29 59	1 34 27	1 13 20	0 31 39	19
12	0 19 32	1 3 9	1 30 32	1 34 9	1 12 15	0 30 13	18
13	0 21 8	1 4 21	1 31 4	1 33 49	1 11 7	0 28 35	17
14	0 22 44	1 5 35	1 31 35	1 33 15	1 9 38	0 26 56	16
15	0 24 19	1 6 46	1 32 3	1 33 4	1 8 48	0 25 18	15
16	0 25 53	1 7 57	1 32 30	1 32 38	1 7 36	0 23 40	14
17	0 27 27	1 9 5	1 32 56	1 32 12	1 6 23	0 22 1	13
18	0 29 2	1 10 13	1 33 19	1 31 44	1 5 10	0 20 21	12
19	0 30 35	1 11 20	1 33 41	1 31 14	1 3 53	0 18 40	11
20	0 32 8	1 12 26	1 34 1	1 30 43	1 2 37	0 16 59	10
21	0 33 41	1 13 29	1 34 20	1 30 8	1 1 19	0 15 17	9
22	0 35 13	1 14 33	1 34 37	1 29 32	1 0 0	0 13 35	8
23	0 36 44	1 15 34	1 34 51	1 28 56	0 58 40	0 11 53	7
24	0 38 14	1 16 35	1 35 4	1 28 18	0 57 18	0 10 12	6
25	0 39 44	1 17 33	1 35 16	1 27 38	0 55 36	0 8 31	5
26	0 41 14	1 18 31	1 35 26	1 26 46	0 54 33	0 6 49	4
27	0 42 43	1 19 27	1 35 34	1 26 12	0 53 9	0 5 7	3
28	0 44 10	1 20 22	1 35 41	1 25 26	0 51 44	0 3 25	2
29	0 45 37	1 21 16	1 35 46	1 24 40	0 50 17	0 1 43	1
30	0 47 3	1 22 7	1 35 49	1 23 52	0 48 49	0 0 0	0
Sun's m. An.	+	+	+	+	+	+	Sun's m. An.
	Sig. 11.	Sig. 10.	Sig. 9.	Sig. 8.	Sig. 7.	Sig. 6.	

Conſtruction. Equat. Sun's Center, with proper Sign, P. 12. + Equat. ☽ Ap. with contr. Sign, P. 61, 62, *Royal Aſt.* ſubtracting the Ap. fr. Eq. ☉'s Center.

PRECEPTS *of* COMPUTATION, *for finding the* Times *of* New *and* Full Moons.

1. FROM *Table* I. continued (P. 21, 22, this *Supplement)* take out the Time of the mean N. Moon, with the reſpective Places of mean Anom. ☉, mean Anom. ☽, and ☉ from the ☽'s Node, O. S. that when any Number of *Julian Centuries,* compoſed of a Number of Lunations, are added thereto and ſubtracted therefrom, (or any Numb. of *Eclipſe-Periods* added or ſubtracted, taken from *Tab.* II. P. 23,) with their reſpective mean Times and Motions connected with the Time of 1ſt New Moon, and Places for *Jan.* the Time of the mean *New Moon* and *Places* correſpondent in *January* ſhall reſult for the given Year, in which the *New* or *Full* Moon for ſome Month in that Year is required. (If which given Year be between 17 and 18 Hundred, you have the Time of the mean *New Moon,* and reſpective mean *Places,* for *Jan. without that Operation.)*

2. Having obtained the mean *N. Moon* in *Jan.* and correſpondent mean Places, for the given Year of *Chriſt,* in 4 *Columns,* you muſt *next* add the Time and reſpective mean *Motion* for the Month of the given Year, *(taken from Tab.* III. P. 24,) when you will have the Time of the mean *New Moon* and correſpondent *Places*; or adding, or ſubtracting, the Time and Motion for ½ Revolution, you have the *Time,* and correſpondent *Places,* of the mean *Full* Moon for that Year

TABLE V. EQUATION of the mean Diſt. of the ☉ fr. ☽'s North ☊.

Argument. Sun's mean Anomaly.

Sun's m. An.	Sig. 0.	Sig. 1.	Sig. 2.	Sig. 3.	Sig. 4.	Sig. 5.	Sun's m. An.
	—	—	—	—	—	—	
0°	0° 0′ 0″	1° 1′ 32″	1° 47′ 24″	2° 5′ 19″	1° 49′ 41″	1° 3′ 50″	30°
1	0 2 8	1 3 24	1 48 30	2 5 20	1 48 36	1 1 53	29
2	0 4 17	1 5 15	1 49 34	2 5 19	1 47 29	0 59 55	28
3	0 6 26	1 7 4	1 50 37	2 5 16	1 46 20	0 57 57	27
4	0 8 35	1 8 52	1 51 36	2 5 11	1 45 8	0 55 58	26
5	0 11 42	1 10 39	1 52 34	2 5 4	1 43 56	0 54 7	25
6	0 12 50	1 12 21	1 53 30	2 4 54	1 42 41	0 51 57	24
7	0 14 58	1 14 30	1 54 27	2 4 47	1 41 23	0 49 55	23
8	0 17 6	1 15 54	1 55 17	2 4 27	1 40 3	0 47 52	22
9	0 19 12	1 17 36	1 56 7	2 4 10	1 38 42	0 45 48	21
10	0 21 19	1 19 16	1 56 55	2 3 53	1 37 20	0 43 42	20
11	0 23 25	1 20 56	1 57 40	2 3 31	1 35 54	0 41 36	19
12	0 25 32	1 22 34	1 58 23	2 3 7	1 34 28	0 40 30	18
13	0 27 37	1 24 9	1 59 16	2 2 51	1 33 0	0 37 23	17
14	0 29 43	1 25 46	1 59 46	2 2 3	1 31 30	0 35 14	16
15	0 31 47	1 27 19	2 0 22	2 1 43	1 29 58	0 33 5	15
16	0 33 51	1 28 11	2 0 58	2 1 10	1 28 24	0 30 56	14
17	0 35 54	1 30 20	2 1 31	2 0 35	1 26 49	0 28 46	13
18	0 37 58	1 31 49	2 2 5	1 59 58	1 25 12	0 26 35	12
19	0 40 0	1 33 17	2 2 31	1 59 19	1 23 33	0 24 24	11
20	0 42 2	1 34 44	2 2 57	1 58 37	1 21 53	0 22 12	10
21	0 44 3	1 36 7	2 3 22	1 57 52	1 20 11	0 19 59	9
22	0 46 3	1 37 29	2 3 43	1 57 5	1 18 27	0 17 46	8
23	0 48 2	1 38 49	2 4 1	1 56 17	1 16 44	0 15 35	7
24	0 50 10	1 40 8	2 4 20	1 55 28	1 14 57	0 13 20	6
25	0 51 58	1 41 25	2 4 35	1 54 36	1 13 10	0 11 7	5
26	0 53 55	1 42 40	2 4 48	1 53 41	1 11 20	0 8 54	4
27	0 55 51	1 43 54	2 4 59	1 52 44	1 9 30	0 6 41	3
28	0 57 46	1 45 6	2 5 8	1 51 44	1 7 39	0 4 52	2
29	0 59 39	1 46 17	2 5 14	1 50 43	1 5 45	0 2 14	1
30	1 1 32	1 47 24	2 5 19	1 49 41	1 3 50	0 0 0	0
Sun's m. An.	+	+	+	+	+	+	Sun's m. An.
	Sig. 11.	Sig. 10.	Sig. 9.	Sig. 8.	Sig. 7.	Sig. 6.	

Conſt. Equat. ☉'s Center, with the proper Sign, P. 12, — Equat. ☽'s ☊, wit contr. Sign, P. 61, 62, *R. Aſtron.* adding this Eq to Eq. Sun's Center.

and Month. — Now, in Order to find the Time of the *true* New or Full Moo from that of the mean, you muſt thus apply *Equation (Tab. IV. P. 25,)* an the above *Equation (Tab. V. P. 26)* in Degrees, with the *following Equations* o Time, deduced from the *Tables* in our *Royal Aſtronomer*.

3. By the *Argument* of the Sun's mean Anomaly, reſpecting the Time of th mean New or Full Moon, take out the Equation, in Degrees and Minutes, o the Moon's mean Anomaly, *(from Tab. IV. P. 25,)* which (according to th Sign) ſubtract from, or add to, the Moon's mean Anomaly correſpondent to th mean N. or F. Moon, for her *equated* (or corrected) Anomaly.

4. Next, by the ſame *Argument* of Sun's mean Anomaly, take out the Equation, in Degrees and Minutes, of the Sun's mean Diſtance from the Moon' *Node, (from Tab. V. P. 26,)* which (according to the Sign) ſubtract from or ad to the Sun's mean Diſtance from the Node, correſpondent to the mean N. and F Moon, for the equated Diſt. of ☉ à ☊.

Now with the Sun's ſame mean Anom. take out *(fr. Tab. VI. P. 27)* the 1ſ Equation in Time of the mean to the true N. or F. Moon, which, according t the Sign, ſubtract from or add to the Time of the mean, for the 1ſt *equated* Time

5. *Next*, by the Moon's *equated Anomaly*, firſt found, *(with 6 Signs added o F. Moon only,)* take out *(from Tab. VII. P. 28)* 2. *Equation*, in Time, of th

mea

TABLE VI. I. EQUATION of the mean to the true New or Full Moon.

Argument. Sun's mean Anomaly.

Sun's m. An.	Sig. 0.			Sig. 1.			Sig. 2.			Sig. 3.			Sig. 4.			Sig. 5.			Sun's m. An.
	—			—			—			—			—			—			
	h	m	s	h	m	s	h	m	s	h	m	s	h	m	s	h	m	s	
0	0	0	0	2	3	20	3	35	18	4	11	16	3	39	57	2	7	58	30
1	0	4	16	2	7	7	3	37	33	4	11	18	3	37	47	2	4	3	29
2	0	8	36	2	10	31	3	39	41	4	11	18	3	35	28	2	0	7	28
3	0	12	53	2	14	27	3	41	47	4	11	8	3	33	10	1	56	11	27
4	0	17	11	2	18	4	3	43	45	4	11	0	3	31	7	1	52	13	26
5	0	21	28	2	21	39	3	45	43	4	10	44	3	28	21	1	48	13	25
6	0	25	43	2	25	4	3	47	35	4	10	27	3	26	10	1	44	8	24
7	0	29	59	2	28	42	3	49	23	4	10	1	3	23	15	1	40	4	23
8	0	34	15	2	32	10	3	51	10	4	9	32	3	20	36	1	35	56	22
9	0	38	29	2	34	57	3	52	49	4	8	56	3	17	55	1	31	46	21
10	0	42	41	2	38	56	3	54	25	4	8	23	3	15	10	1	27	34	20
11	0	46	55	2	42	17	3	55	55	4	7	39	3	12	28	1	23	22	19
12	0	51	9	2	45	32	3	57	22	4	6	38	3	9	26	1	19	13	18
13	0	55	23	2	48	43	3	58	48	4	5	59	3	6	28	1	14	57	17
14	0	59	31	2	51	56	4	0	11	4	5	2	3	3	27	1	10	40	16
15	1	3	41	2	55	7	4	1	24	4	4	3	3	0	22	1	6	21	15
16	1	7	49	2	58	8	4	2	35	4	2	54	2	57	15	1	2	1	14
17	1	11	57	3	1	9	4	3	41	4	1	45	2	54	4	0	57	41	13
18	1	16	5	3	4	6	4	4	40	4	0	33	2	50	49	0	53	59	12
19	1	20	11	3	7	2	4	5	37	3	59	13	2	47	30	0	48	54	11
20	1	24	16	3	9	55	4	6	31	3	57	51	2	44	11	0	44	32	10
21	1	28	20	3	12	42	4	7	22	3	56	19	2	40	49	0	40	4	9
22	1	32	20	3	15	27	4	8	5	3	54	47	2	37	19	0	35	38	8
23	1	36	20	3	18	9	4	8	45	3	53	12	2	33	51	0	31	12	7
24	1	40	14	3	20	49	4	9	26	3	51	36	2	30	14	0	26	45	6
25	1	44	10	3	23	23	4	9	50	3	49	47	2	26	40	0	22	17	5
26	1	46	7	3	25	54	4	10	15	3	48	7	2	23	2	0	17	49	4
27	1	51	57	3	28	19	4	10	36	3	46	4	2	19	20	0	13	23	3
28	1	56	7	3	30	43	4	10	34	3	44	2	2	15	36	0	8	57	2
29	1	59	36	3	33	14	4	11	6	3	42	0	2	11	48	0	4	28	1
30	2	3	20	3	35	18	4	11	16	3	39	57	2	7	58	0	0	0	0
Sun's m. An.	+			+			+			+			+			+			Sun's m. An.
	Sig. 11			Sig. 10.			Sig. 9.			Sig. 8.			Sig. 7.			Sig. 6.			

Construction, Equat. Sun's Center, with proper Sign, P. 12. + 1 Eq. ☽, with *contrary* Sign; P. 61, 62, *Royal Aſtr.* — Adding this Equat. ☽ to Equat. ☽'s Center reduced to Time in mean Mot. ☽ fr. ☉.

mean to the true N. or F. Moon, which, according to the Sign, add to or ſubtract from the 1ſt equated, for the 2d equated Time.

6. *Next,* by the Remainder of the ☽'s mean Anomaly deducted from the Sun's mean Anomaly, *(adding 6 Signs at F. Moon only to that Remainder,)* take out *(from Tab.* VIII. *P.* 29) 3d Equation, in Time, of the mean to the true N. or F. Moon, which, according to the Sign, ſubtract from or add to the 2d equated, for the 3d equated, Time.

7. *Next,* by the Arg. ☉ fr. ☊ equated, take out *(from Tab.* IX. *P.* 29) 4th *Equation,* in Time, of mean to true N. or F. Moon, which, according to the Sign, add to or ſubtract from the 3d for the 4th equated Time; being the true Time of the Orbit Conjunction or Oppoſition of the N. or F. Moon, req.

8. *Laſtly,* by the Sun from the Node equated, *(adding 6 Signs at Full Moon only)* take out *(from Tab.* X. P. 29) the laſt Equation, in Time, of the mean to the true N. or F. Moon, which, according to the Sign, add to or ſubtract from the Time of the Orbit Conjunction or Oppoſition, for the near Time of the Ecliptic Conjunction or Oppoſition, required.

TAB. VII. II. EQUATION of the mean to the true New or Full Moon.

Arg. Moon's *equated* Anomaly for *New*; + 6 Signs for *Full* Moon.

☽'s eq. An.	Sig. 0. +	Sig. 1. +	Sig. 2. +	Sig. 3. +	Sig. 4. +	Sig. 5. +	☽'s eq. An.
0	$0^h\ 0^m\ 0^s$	$5^h\,12^m\,47^s$	$8^h\,47^m\,8^s$	$9^h\,46^m\,14^s$	$8^h\,8^m\,54^s$	$4^h\,34^m\,17^s$	30
1	0 11 2	5 21 59	8 51 45	9 45 52	8 3 21	4 26 0	29
2	0 22 3	5 31 2	8 56 10	9 44 22	7 57 41	4 17 25	28
3	0 33 3	5 40 0	9 0 26	9 43 9	7 51 53	4 8 47	27
4	0 44 4	5 48 50	9 4 31	9 41 44	7 45 54	4 0 5	26
5	0 55 4	5 57 33	9 8 25	9 40 11	7 39 52	3 51 22	25
6	1 6 3	6 6 9	9 12 7	9 38 28	7 33 43	3 42 31	24
7	1 16 59	6 14 35	9 15 40	9 36 34	7 27 25	3 33 37	23
8	1 27 52	6 22 55	9 19 3	9 34 29	7 21 1	3 24 42	22
9	1 38 44	6 31 7	9 22 14	9 32 15	7 14 29	3 15 45	21
10	1 49 36	6 39 10	9 25 11	9 29 49	7 7 48	3 6 46	20
11	2 1 12	6 47 3	9 28 8	9 27 13	7 1 2	2 57 43	19
12	2 11 9	6 54 47	9 30 36	9 23 31	6 54 9	2 48 36	18
13	2 21 53	7 2 23	9 33 4	9 21 37	6 47 11	2 39 24	17
14	2 32 34	7 9 49	9 35 18	9 18 32	6 40 7	2 30 13	16
15	2 43 10	7 17 6	9 37 20	9 15 19	6 32 58	2 21 0	15
16	2 53 41	7 24 16	9 39 14	9 11 55	6 25 40	2 11 44	14
17	3 4 6	7 31 17	9 40 56	9 8 23	6 18 20	2 2 29	13
18	3 14 31	7 38 9	9 42 26	9 4 43	6 10 50	1 53 12	12
19	3 24 50	7 44 48	9 43 47	9 0 53	6 3 15	1 43 51	11
20	3 35 6	7 51 18	9 44 57	8 56 52	5 55 37	1 34 30	10
21	3 45 18	7 57 38	9 45 54	8 52 42	5 47 52	1 25 7	9
22	3 55 28	8 3 54	9 46 39	8 48 24	5 40 4	1 15 44	8
23	4 5 28	8 9 51	9 47 13	8 43 59	5 32 10	1 6 20	7
24	4 15 23	8 15 41	9 47 38	8 39 24	5 24 9	0 56 51	6
25	4 25 13	8 21 22	0 47 50	8 34 37	5 16 3	0 47 23	5
26	4 34 59	8 26 50	9 47 52	8 29 45	5 7 54	0 37 56	4
27	4 44 38	8 32 8	9 47 42	8 24 44	4 59 42	0 28 27	3
28	4 54 7	8 37 19	9 47 24	8 19 36	4 51 24	0 18 59	2
29	5 3 30	8 42 10	9 46 55	8 14 19	4 43 0	0 9 30	1
30	5 12 47	8 47 8	9 46 14	8 8 54	4 34 17	0 0 0	0
☽'s eq. An.	− Sig. 11.	− Sig. 10.	− Sig. 9.	− Sig. 8.	− Sig. 7.	− Sig. 6.	☽'s eq. An.

Conſt. Eq. ☽ Center at m. N. and F. with 2d lunar Eq. P. 63, *R. Aſt.* comp^d; or Eq. P. 390, *R. Aſt.* reduced to Time in mean Mot. ☽ à ⊙, with *contr.* Sign.

Ex. I. *To find the Time of the true* New Moon, *in* April 1764.

By PRECEPTS P. 22, 1764, O. S. this *Palladium*	Mean N. ☽, in *January.*	Su 's m. An.	☽'s m. Ap. or ⊙ à ☽ Ap.	⊙ m. Dis. à ☊
	$21^d\,20^h$ 10 59	$7^s\ 3^\circ\,10'$ 34	$9^s\ 17^\circ\,46'$ 25	$10^s\ 4^\circ\,14'$ 29
P. 24. *Feb.*	28 1 28 6	1 28 12 39	1 21 38 1	2 10 20 28
Mean N. ☽ *Mar.* O. S.	20 21 39 5	9 1 23 13	11 9 24 26	0 5 34 57
1st *Equation*	+ 4 10 54	Arg. 1. Eq.	+ 1 35 44	+ 2 5 11
Mean N. ☽. 1st eq.	21 1 49 59	−11 9 24 26	Eq. ☽ m. An.	Eq. ⊙ fr. ☊.
2d *Equation*	− 3 24 48	9 21 58 47	11 11 0 10	0 7 40 8
Mean N. ☽. 2d eq	20 22 25 11	Arg. 3d. Eq.	Arg. 2d. Eq.	Arg. 4. & 5. Eq.
3d *Equation*	+ 4 24			
Mean N. ☽. 3d eq.	20 22 29 35			
4th *Equation*	+ 25			
Orbit N. ☽. *Mar.*	20 22 30 0			
5th *Equation*	+ 3 37			
Ecliptic N. Moon	20 22 33 37			
Between O. & N. S.	11 Days +			
N. S. 1764, *Apr.*	1 22 33 37			

The ANSWER.

N. S. *Apr.* $1^d\ 22^h\ 30^m\ 0^s$, *Orbit* N. M.

N. S. *Apr.* $1^d\ 22^h\ 33^m\ 37^s$, *Ecliptic* N. M.

TABLE VIII. 3 Eq. of mean to true New or Full Moon.

A. ☉ m. An. — ☽ m An at New; at Full + 6^{s}.

Arg. prop.	Sig^{s}. 0 — 6 +		Sig^{s}. 1 — 7 +		Sig^{s}. 2 — 8 +		Arg. prop.
	m	s	m	s	m	s	
0	0	0	2	22	4	6	30
1	0	4	2	28	4	10	29
2	0	10	2	31	4	12	28
3	0	14	2	35	4	14	27
4	0	20	2	39	4	16	26
5	0	24	2	43	4	18	25
6	0	30	2	47	4	20	24
7	0	33	2	51	4	22	23
8	0	39	2	55	4	24	22
9	0	43	2	59	4	26	21
10	0	49	3	3	4	27	20
11	0	53	3	7	4	29	19
12	0	59	3	11	4	29	18
13	1	3	3	15	4	31	17
14	1	9	3	19	4	33	16
15	1	13	3	23	4	35	15
16	1	19	3	25	4	35	14
17	1	23	3	29	4	37	13
18	1	27	3	33	4	37	12
19	1	31	3	34	4	39	11
20	1	37	3	38	4	39	10
21	1	40	3	40	4	41	9
22	1	46	3	44	4	41	8
23	1	50	3	46	4	43	7
24	1	56	3	50	4	43	6
25	2	0	3	52	4	43	5
26	2	4	3	56	4	43	4
27	2	8	3	58	4	45	3
28	2	14	4	2	4	45	2
29	2	18	4	4	4	45	1
30	2	22	4	6	4	45	0
Arg. pr.	5 — 11 + Sig^{s}.		4 — 10 + Sig^{s}		3 — 9 + Sig^{s}.		Arg. pr.

Conſtr. 6th Lunar Equation, P. 74. *R. Aſt.* reduced to Time in mean Mot. ☽ à ☉, with a *contrary* Sign.

TAB. IX. 4 Equat. of mean to true N. or F. ☽ in her Orbit.

Argument.
☉ from ☊ equated.

☉ à ☊	Sig^{s}. 0 6 +		Sig^{s}. 1 7 +		Sig^{s}. 2 8 +		☉ à ☊
	m	s	m	s	m	s	
0	0	0	1	21	1	21	30
1	0	4	1	21	1	19	29
2	0	6	1	23	1	17	28
3	0	10	1	25	1	15	27
4	0	14	1	27	1	13	26
5	0	16	1	27	1	11	25
6	0	20	1	29	1	9	24
7	0	22	1	29	1	7	23
8	0	26	1	31	1	5	22
9	0	30	1	31	1	1	21
10	0	31	1	31	0	59	20
11	0	35	1	33	0	57	19
12	0	37	1	33	0	55	18
13	0	41	1	33	0	51	17
14	0	43	1	33	0	49	16
15	0	47	1	33	0	47	15
16	0	49	1	33	0	43	14
17	0	51	1	33	0	41	13
18	0	55	1	33	0	37	12
19	0	57	1	33	0	35	11
20	0	59	1	31	0	31	10
21	1	1	1	31	0	29	9
22	1	5	1	31	0	26	8
23	1	7	1	29	0	22	7
24	1	9	1	29	0	20	6
25	1	11	1	27	0	16	5
26	1	13	1	27	0	14	4
27	1	15	1	25	0	10	3
28	1	17	1	23	0	6	2
29	1	19	1	21	0	4	1
30	1	21	1	21	0	0	0
☉ à ☊	5 — 11 Sig^{s}		4 — 10 Sig^{s}.		3 — 9 Sig^{s}.		☉ à ☊

Conſtr. 3d Lunar Equation, P. 63. *R. Aſt.* reduced to Time in Mot. ☽ à ☉, with a *contrary* Sign.

TABLE X. 5 Equat. of mean to true N. or F. Moon in the Ecliptic.

Arg. ☉ à ☊ equated at New; + 6 Signs at Full.

☉ à ☊	Sig^{s}. 0 6 +		Sig^{s}. 1 7 +		Sig^{s}. 2 8 +		☉ à ☊
	m	s	m	s	m	s	
0	0	0	11	53	11	53	30
1	0	28	12	6	11	39	29
2	0	57	12	18	11	23	28
3	1	24	12	30	11	7	27
4	1	54	12	42	10	50	26
5	2	22	12	52	10	30	25
6	2	49	13	2	10	10	24
7	3	19	13	9	9	51	23
8	3	46	13	17	9	31	22
9	4	14	13	23	9	9	21
10	4	41	13	29	8	48	20
11	5	9	13	35	8	26	19
12	5	35	13	39	8	2	18
13	6	0	13	41	7	39	17
14	6	26	13	41	7	15	16
15	6	51	13	41	6	51	15
16	7	15	13	41	6	26	14
17	7	38	13	41	6	0	13
18	8	2	13	39	5	35	12
19	8	26	13	35	5	9	11
20	8	48	13	29	4	42	10
21	9	9	13	23	4	14	9
22	9	31	13	17	3	47	8
23	9	50	13	9	3	19	7
24	10	10	13	2	2	49	6
25	10	30	12	52	2	22	5
26	10	50	12	42	1	54	4
27	11	7	12	30	1	26	3
28	11	23	12	18	0	57	2
29	11	39	12	6	0	28	1
30	11	53	11	53	0	0	0
☉ à ☊	5 — 11 Sig^{s}		4 — 10 Sig^{s}.		3 — 9 Sig^{s}.		☉ à ☊

Conſtruction. The Reduction Equation, P. 52. *R. Aſtron.* reduced to Time in mean Motion ☽ à ☉, with a *contrary* Sign.

But for finding the *Orbit* and *Ecliptic* Conjunction and Oppoſition ſeparately, the IX. and X. *Equations*, having the ſame Argument, *(except the latter* + *6 Signs at Full Moon,)* might be compounded.

Thus the *Supplemental Equations*, treaſured in the *Royal Aſtronomer*, are found to be as good as *old Gold*, and will make this *Palladium-Supplement* laſt as long as the *Sun* and *Moon* endure. — But we ſhall hereafter give Equations of the Moon, in Time, when in *Syzygies*, according to a *new* and *different Conſtruction*. The *lunar Computation* corrected by the *Plinian* Period, of 18 Years Obſervations, is the only ſure Method of obtaining the Moon's correct *Place*, in any Part of her *Orbit*.

Ex. II. *To find the Time of the* Orbit *and* Ecliptic Full Moon, *at* Greenwich *Obſervatory, in* May, 1762.

By *Precepts* in this *Palladium*, P.	Mean N. ☽, in *January*.	Pl. ☉'s m. An.	Pl. ☽'s m. An.	M. Diſt. ☉ à ☊.
22, 1762, O.S.	$13^{d}13^{h}$ 49 43	$6^{s}25^{\circ}32'$ 32	0^{s} $2^{\circ}21'$ 14	$8^{s}17^{\circ}28'41''$
P24. Mo. for *Mar.*	29 14 12 9	2 27 18 58	2 17 27 1	3 2 0 42
Mot. for ½ Revol.	14 18 22 2	0 14 33 10	0 12 54 30	0 15 20 7
M.F. ☽, *Ap.* O.S.	26 22 23 54	10 7 24 40	3 2 42 46	0 4 49 30
1ſt Equation	+ 3 17 2	Arg. 1ſt Eq.	Eq. +1 14 33	Eq. —1 38 16
M. Time 1 eq	27 1 40 56	—3 2 42 45		
2d Equation	— 9 47 51	7 4 41 35	3 3 57 18	0 3 11 14
M. Time 2. eq.	26 15 53 5	+6 at Full ☽.	+6 at Full ☽.	Arg. 4th Eq,
3d Equation	— 2 41			+6 at Full ☽.
M. T. 3. equated	26 15 50 24	1 4 41 35	9 3 57 18	6 3 11 14
4th Equation	+ 11	Arg. 3d Eq.	Arg. 2d Eq.	Arg. 5th Eq.
Orbit F. ☽, *Apr.*	26 15 50 35	*May* 7^{d} 15^{h} 50^{m} 35^{s} *Orbit* Full ☽, at *Green-*		
5th Equation	+ 1 29	[*wich*, required.		
Ecliptic F. ☽, *Ap.*	26 15 52 4	*May* 7^{d} 15^{h} 52^{m} 4^{s} *Ecliptic* Full ☽, at *Green-*		
Dif. bet. O.&N.S.	11 Days +	[*wich*, required.		
1762, N. S *May*	7 15 52 4	The ANSWER. 1762, ſince *Chriſt*, N.S.		

☞ Mr. *Ferguſon* not *ſetting down the* 6 *Signs be added at Full Moon, they could not be ſeen.* — Which we give up to *Truth*; while he has failed in *Method* and *Correction.* — We are beneſited by his *Miſtakes* or *Blunders* throughout his *Tables*; *with which we compared and corrected our own*; whoſe *printed* Miſtakes, in all his *Tables*, have therefore been of great Uſe to us.

Ex. III. *To find the Time of the* Orbit *and* Ecliptic Full Moon *at* Greenwich *Obſervatory, in the* 30*th Year current ſince* Chriſt, *O. S.*

By *Precepts* in this *Palladium*, P.	Mean N. ☽, in *January*.	Pl. ☉'s m. An.	Pl. ☽'s m. An	M. Diſt. ☉ à ☊.
21, 1730, O.S.	$7^{d}11^{h}$ 5 35	$6^{s}19^{\circ}49'$21	7^{s} $8^{\circ}54'$22	$11^{s}21^{\circ}56'$42
P.24. for ½ Rev. +	14 18 22 2	0 14 33 10	0 12 54 30	0 15 20 7
M.F. ☽, 1730 *Ja.*	22 5 27 37	7 4 22 31	7 21 48 52	0 7 16 49
P22. 1700y mo. —	14 17 36 44	11 28 22 58	10.29 35 41	4 29 23 28
M.○ in 30ſ.C. *Ja.*	7 11 50 53	7 5 59 33	8 22 13 11	7 7 53 21
P.24. Mo. for *Mar.*	29 14 12 9	2 27 18 58	2 17 27 1	3 2 0 42
M.F. ☽, 30, *Apr*	6 2 3 2	10 3 18 31	11 9 40 12	10 9 54 3
1ſt Equation	+ 3 27 34	Arg. 1ſt Eq	Eq. +1 19 10	Eq. +1 43 31
M. Time 1. eq.	6 5 32 36	—11 9 40 12		10 11 37 34
2d Equation	+ 2 57 47	10 23 38 19	11 10 59 22	Arg. 4th Eq.
M. Time 2. eq	6 8 30 23	+ 6 at Full ☽.	+6 at Full ☽.	+6 at Full ☽.
3d Equation	— 2 48	4 23 38 19	5 10 59 22	4 11 37 34
M. Time 3. eq	6 8 27 35	Arg. 3d Eq.	Arg. 2d Eq.	Arg. 5th Eq.
4th Equation	— 1 33	The ANSWER. 30 ſince *Chriſt*, O. S.		
Orbit F. ☽, *Apr*	6 8 26 2	*Apr.* 6^{d} 8^{h} 26^{m} 2^{s}, *Orbit* Full ☽, required.		
5th Equation	— 13 37			
Ecliptic F. ☽, *Ap*	6 8 12 25	*Apr.* 6^{d} 8^{h} 12^{m} 25^{s}, *Ecliptic* Full ☽, required.		

ANNOTATIONS.

THE above *Examples* are all in *equal Time*; which cannot be reduced to *apparent Time*, but by Means of the Sun's *true Place*; giving the Equation of *Time*, to be *added* to, or *ſubtracted* from, the computed *equal*, for the Time *apparent*.

☞ Though it appears, by the *foregoing Examples*, that Mr. *Ferguſon* has added the 6 Signs of mean Anomaly at Full Moon, that we unjuſtly charged him with omitting, becauſe he had not ſet them down to be *ſeen*, but added them *in obſcuro*, or in the dark; yet it appears, that he has omitted the *Reduction-Equa-*

tion

Ex. IV. *To find the Time of the* Orbit *and* Ecliptic New Moon, *at* Greenwich, *for* May, *in the* 585*th Year current before* Chriſt, *O. S.*

By *Precepts* in this *Palladium*,	Mean New ☽ in *January*.	Pl, ☉'s m. An	Pl. ☽ m. An.	M. Diſt. ☉ à ☊
P. 21. 1716, O. S.	12d 16h 4 48	6 24 35 33	2s 12° 36′ 7	2s 25° 56′ 32
P. 23. 2300ys. mo.—	11 5 57 54	11 19 15 5	1 5 58 33	7 25 26 59
Dif+1is585b. *C. Ja.*	1 10 6 54	7 5 20 28	1 6 37 34	7 0 29 33
P24. Mo. for *May* Biſ.	+26 15 40 15	4 25 31 37	4 9 5 2	5 3 21 10
M. n. ☽ 585b. *C. May*	28 1 47 9	0 0 52 5	5 15 42 36	0 3 50 43
1ſt Equation	− 3 51	Arg. 1ſt Eq.	Eq. −1 26	Eq. −1 41
M. Time 1. equated	28 1 43 18	−5 15 42 36		
2d Equation	+ 2 15 30	6 15 9 29	5 15 41 10	0 3 49 2
M. Time 2. equated	28 3 58 48	Arg. 3d Eq.	Arg. 2d Eq.	Arg 4. & 5. Eq.
3d Eqaation	+ 1 14			
M. Time 3, equated	28 4 0 2			
4th Equation	+ 13			
Orbit N. ☽, *May*	28 4 0 15			
5th Equation	+ 1 48			
Ecliptic N. ☽, *May*	28 4 2 3			

The ANSWER.

585 current before *Chriſt*, O. S.

May 28d 4h 0m 15s *Orbit* N. ☽, } *Green-*
May 28d 4h 2m 3s *Ecliptic* N. ☽ } *wich,* req.

ANNOTATIONS *continued.*

tion of the Moon, from her *Orbit* to the *Ecliptic*, in every one of his *Examples* of computing the Times of the *New* and *Full* Moons; who has thereby eſtabliſhed an *Error*, at greateſt, (in 1s and 7s, 15°, or 4s and 10s, 15°, ☉ à ☊,) of 13m 48s, *more or leſs* than the Times of New and Full Moons, according to his *Method of Computation*.

He has *erred* by ſome *Minutes* of Time, in ſeveral Places, in the Compoſition of his *lunar Equations*, in *Syzygies*, and in reducing them to Time, in mean Motion of ☽ à ☉.

This will appear *conſpicuous* to the Reader, if he compares our preceding *Tables*, and their *Conſtruction*, with his *Tables* and the ſame *Conſtruction*; which are both according to the *Principles* and *Precepts* we have given in our *Royal Aſtronomer and Navigator*, (P. 393,) excepting his Omiſſion to *double* one of *Newton*'s Equations, as we directed; *viz.* 6th Equation, P. 74, *R. Aſtron.* containing the *Arg. of his and our 4th Equation.* — All his Arguments and Equations are otherwiſe the ſame with *ours*; excepting that the Quantities and Conſtruction of his Equations *(originally given in the celebrated* Halley's *Tables)* are all by him a little varied from the Truth, and incorrectly compounded and reduced to Time.

Though we firſt gave Mr. F. Notice of his *Error* of reducing (in his Book of *Aſtronomy)* the *lunar Equations* to Time, in mean Motion of the *Moon*, inſtead of the *Moon from the Sun*, and ſhewed ſeveral of his *computed Errors* contraſted with the Truth, *(ſee* P. 396, *R. Aſtron.)* he, we obſerve, has ſince altered his Tables in his *Aſtronomy*, without acknowledging it, by reprinting a Sheet or two, where the Errors we communicated lay; according to our demonſtrated *Propoſition*, P. 393, *R. Aſtr.* Who nevertheleſs is not yet right in what he calls his *Third Edition* of *Aſtronomy*, *(or Title of his Firſt Edition twice altered, with Additions,)* though no Puff when a Book ſells.

Mr. F. *miſtakes* in deducting the *equated* Moon's Anomaly *(which is but the Sun from the Moon's Apogee)* from the Sun's mean Anomaly, in the *Argument of the 4th Equation*, *Halley*'s Precepts and *ours* direct otherwiſe.

So that the Moon's mean Anomaly (or rather the *Sun from the Moon's Apogee)* taken from the Sun's mean Anomaly, *(as we direct,)* is as correct, as if the ☽'s equated Anomaly *(by the Sun's Equation and* ☽*'s Ap.)* were taken from the *Sun*'s equated Anomaly; which ſhould be equated when the *Moon*'s equated Anomaly is taken from it, for the *Argument of the 4th Equation*. — Mr. F. miſcalls (by a *Transformation of Ideas)* the *Sun from the Moon's Apogee*, *in Syzygies*, *or annual Argument*, the *Moon's mean Anomaly*. — Whereas, if the Computer try his Numbers, in his *Aſtronomy*, or thoſe from any other *Tables*, he will find the

Sun's

Ex. V. *To find the Time of the* Orbit *and* Ecliptic *Full Moon, at* Alexandria, *in* Egypt, *for* September, *in* 201 *current before* Chriſt, *O. S.*

N. B. Between 201 before, and 1700 ſince, *Chriſt*, are 1900 Years.

By *Precepts* in this *Palladium*.	Mean New ☽ in *January*.				Pl. ☉'s m. An.				Pl. ☽'s m. An.				M. Diſt. ☉ à ☊			
	d	h	m	s	s	°	′	″	s	°	′	″	s	°	′	″
P. 21, 1700, O. S.	9	14	42	44	6	21	43	53	0	0	52	40	4	13	10	32
P. 24 for ½ Revol.	14	18	22	2	0	14	33	10	0	12	54	30	0	15	20	7
Mean Full ☽ in *Jan*	24	9	4	46	7	6	17	3	0	13	47	10	4	28	30	39
P. 23, 1900 ys. Mo.—	23	9	58	28	0	5	2	27	4	0	19	39	2	8	18	3
M. F. ☽ 201, b. *C. Ja.*	0	23	6	18	7	1	14	36	8	13	27	31	2	20	12	36
P. 24, for *Sept.* Biſ.	21	18	36	27	8	21	56	53	7	22	21	4	9	6	2	5
M. F. ☽ 201 b. *C. Sep.*	22	17	42	45	3	23	11	29	4	5	48	35	11	26	14	41
1ſt Equation	—	3	52	54	Arg. 1ſt Eq.				Eq.—	1	28	49	E.—	1	56	8
M. Time 1. equated	22	13	49	51	—4	5	48	35					11	24	18	33
2d Equation	—	8	25	0	11	17	12	54	4	4	19	46	Arg. 4th Eq.			
M. Time 2. equated	22	5	24	51	+6 at Full ☽.				+6 at Full ☽.				6 at Full +			
3d Eqnation		—	1	2	5	17	[illegible]	[illegible]	10	4	19	46	5	24	18	33
M. Time 3. equated	22	5	23	49	Arg. [illegible] Eq.				Arg. 2d Eq.				Arg. 5th Eq.			
4th Equation			—	19												
Orbit Full ☽, *Sept.*	22	5	23	30												
5th Equation		—	2	41												
Ecliptic Full ☽, *Sept.*	22	5	20	49												
Add for *Alexandria*		2	1	6												
P. 1. *R. Aſtron.*	22	7	21	55												

The ANSWER. 201 before *Chriſt*, O. S.

Sep. 22^d 5^h 23^m 30^s *Orb.* F. ☽, *Greenw.* req.

Sep. 22^d 5^h 20^m 49^s *Ecl.* F. ☽, *Greenw.* req.

Sep. 22^d 7^h 21^m 55^s *Ecl.* F. ☽, *Alexand.* req.

☞ *Compare the above Operation with Mr.* Ferguſon'*s prolix and erroneous Operation, (adding 6 Lunations and uſing an inferior Conſtruction,) at P.* 40 *of his Half-Crown aſtronomical Pamphlet.*

ANNOTATIONS *continued.*

Sun's Diſtance from the Moon's Apogee will not correſpond with the *Diſtance* he gives of the *Moon from the Moon's Apogee*; being her real mean Anomaly. — But, to conform to Mr. F.'s *Transformation*, we have called *(after him)* the *Sun from the Moon's Apogee* the *Moon's mean Anomaly*; as being *nearly ſo*, and *ſerving our Purpoſe*; though by a *wrong Appellation*, (as ſome are miſcalled great Aſtronomers,) *to open this* Ferguſonian *Myſtery*; as we ſhall *ſympathize*, for the preſent, with *Aſtronomy opened at* Honiton, *in* Devon, *to unfold a myſterious Abſurdity*, by a *Couſin, Counſellor*, and *Succeſſor*, to *Bamſyde*, late King of the Gypſies and Beggars!

Mr. F. has not yet *equated* the *Sun from the Moon's Node*, by Equation of the *Sun and Node* compounded. Who ſhould reprint farther Alterations of this Kind, and call his *Aſtronomy* the *Fourth glorious Edition*, and ſo on to a *Fifth, Sixth, &c.* to the 21*ſt Edition*, when a Book is reckoned to be of *Maturity* and to be come of Age; though but a *Minor* before it has paſſed through all thoſe eſſential Dignities and *bibliopolian* Gradations!

REMARKS.

WHEN Mr. *Brown*'s Solution (publiſhed in the *Supplement* to the *Lond. Mag.* 1764) is duly compared with *Solutions*, P. 56 and 57, *Pallad.* 1763, to the ſame *Queſtion* of his, we ſhall do him *Juſtice*, if he is right. Which he can only be, provided the *Curve does not run without the Baſe at the Bottom*; and this cannot be known but by Trial: becauſe he has not given the Value of BG, nor of DK, by which it might be determined. *As it requires Time and Trouble to compute them, and he neglected to ſend us his own Solution*, (as if he had found or borrowed one ſince,) *he muſt wait our Leiſure to do it for him till the next* Palladium *comes out.*

The *Solidity* of the *inſcribed Solid* muſt be computed *both Ways*, by Mr. *Johnſon*'s and Mr. *B.*'s Method, before it can be told which gives the true *Maximum.*

Mr.

Ex. VI. *To find the Time of the* Orbit *and* Ecliptic *Full Moon, at* Babylon, *for* October, *in the 4008th Year current before* Chriſt, *O. S.*

N. B. Between 4008 current before, and 1793 current ſince, *Chriſt*, are 5800 Years.

By *Precepts* in this *Palladium.*	Mean New ☽ in *January.*				Pl. ☉'s m. An.				Pl. ☽'s m. An.				M.Diſt. ☉ à ☊			
	d	h	m	s	s	°	'	"	s	°	'	"	s	°	'	"
P. 22, 1763, O. S.	0	19	1	11	6	12	53	41	5	20	11	1	4	4	17	40
P. 24, for ½ Revol.	14	18	22	2	0	14	33	10	0	12	54	30	0	15	27	7
Add 1 Lunation	29	12	44	3	0	29	6	19	0	25	49	0	1	0	40	14
	45	2	7	16	7	26	33	10	6	28	54	31	5	20	25	1
P. 23, 2800ys. Mo.	3	10	8	13	11	6	47	28	6	26	59	27	6	2	3	12
3000ys. Mo.	12	2	29	57	11	13	26	57	11	27	43	25	3	10	57	47
Sum 5800ys. Mo.—	15	12	38	10	10	20	14	25	6	24	42	52	9	13	0	59
M.F. ☽ 4008b.C. *Ja.*	29	13	29	6	9	6	18	45	0	4	11	39	8	7	24	2
P. 24, Mot. for *Sep.* +	22	18	36	27	8	21	56	53	7	22	21	4	9	6	2	5
M.F. ☽ 4008 b.C. *Oc.*	22	8	5	33	5	28	15	38	7	26	32	43	5	13	26	7
1ſt Equation		—	8	3	Arg. 1ſt Eq.				Eq. —		2	59	Eq. —		4	11
M. Time 1. equated	22	7	57	30	—7	26	32	43					5	13	21	56
2d Equation	+	8	29	57	10	1	42	55	7	26	29	44	Arg. 4th Eq.			
M. Time 2. equated	22	16	27	27	+6 at Full ☽.				+6 at Full ☽.				6 + at Full.			
3d Equation		—	4	3	4	1	42	55	1	26	29	44	11	13	21	56
M. Time 3. equated	22	16	23	24	Arg. 3d Eq.				Arg. 2d Eq.				Arg. 5th Eq.			
4th Equation		—	1	33												
Orbit Full ☽, *Oct.*	22	16	21	51												
5th Equation		—	13	41												
Ecliptic Full ☽, *Oct.*	22	16	8	10												
Add for *Babylon* P. 1, R. *Aſtr.*		2	51	6												
	22	18	59	16												
P. 41. *Ferg.* Pamph.	22	18	42	46												
His *Error*			16	30												

The ANSWER. 4008 cur. bef. *Chriſt*, O. S.

Orbit Full ☽, *Oct.* $22^{d}\ 16^{h}\ 21^{m}\ 51^{s}$, at [*Greenwich*.

Ecliptic Full ☽, *Oct.* $22^{d}\ 16^{h}\ 8^{m}\ 10^{s}$, at [*Greenwich*.

Ecliptic Full ☽, *Oct.* $22^{d}\ 18^{h}\ 59^{m}\ 16^{s}$, at [*Babylon*, in *Aſia*.

Being the equal Time of Kennedy's *Creation Full Moon; which he makes on the 24th of* October, *though it happened on* October 23, *at 7 in the Morning truly.*

Mr. *F.* is the firſt *Undiſtinguiſher* and *Confounder* of clear Diſtinction, of Years before *Chriſt*, by calling them *Years bef. 1ſt of Chriſt*, or *before his Birth*, whereas 1ſt Yr. cur. bef. *&c.* precedes, in Succeſſion, 1ſt, *&c.* Yr. cur. ſince, or of *Chr.*

REMARKS.

Mr. *Brown*, of *Portſmouth*, would do well to diverſify his Subjects, in what is uſeful, and own his *Miſtakes*, proved againſt him, he has committed in *Navigation*; and when he gives up his *Errors* for *Truth* to Others, no Doubt they will (or we ſhall for them) do the ſame by him.

As for Mother *Bamfield* and Father *Kennedy*, or any ſuch as theſe, who write not for Truth, they are beſt anſwered by that good Lady, Mrs. *Gooſequill*, at *Batterſea*; unleſs Mr. *Ferguſon*, or ſome more *conſpicuous* (*Antiblunderbuſque*) Writer will take them in Hand. — For whoſe *ſuperſtitious*, *chimerical*, and *abſurd* aſtronomical Improvements, the *one* is hereby conſtituted and appointed METROPOLITAN, and the *other* ASTRONOMICAL PROFESSOR, to all the *lunarian Dominions*: From whoſe Intercourſe with which *Inhabitants*, ſuch prodigious Advantages to this Nation, in *Religion*, *Science*, *Trade*, *&c.* are juſtly to be expected!

Ex. VII. *To find the Time of the* Orbit *and* Ecliptic *New Moon, at* Greenwich, *for* July, *in* 2180 *ſince* Chriſt, O. S.

N. B. 400 added to 1780 is equal to 2180.

By *Precepts* in this *Palladium.*	Mean New ☽ in *January.*				Pl. ☉'s m. An.				Pl. ☽'s m. An.				M.Diſt. ☉ à ☊			
	d	h	m	s	s	°	′	″	s	°	′	″	s	°	′	″
P. 22, 1780, O.S.	24	21	33	3	7	6	2	14	11	29	29	52	8	17	0	19
P. 23. Mo. 400 Ys. +	17	8	43	20	0	13	18	56	10	1	27	56	6	17	49	10
	42	6	16	32	7	19	21	10	10	0	57	48	2	34	49	29
Deduct 1 Lunation	29	12	44	3	0	29	6	19	0	25	49	0	1	10	40	14
M.N. ☽ 2180 *Jan.*	12	17	32	29	6	20	14	51	9	5	8	48	1	34	9	15
P. 24 Mo. for *Jun.* Biſ.	25	4	24	18	5	24	37	56	5	4	54	3	6	4	1	24
M.N. ☽, 2180, *July*	7	21	56	47	0	14	52	47	2	10	2	51	8	8	10	39
1ſt Equation	—	1	3	10	Arg. 1ſt Eq.				Eq. —		24	7	Eq. —		27	51
M. Time 1. equated	7	20	53	37	—2	10	2	51								
2d Equation	+	9	24	8	10	4	49	56	2	9	38	44	8	7	42	48
M. Time 2. equated	8	6	17	45	Arg. 3d Eq.				Arg. 2d Eq.				Arg. 4. & 5. Eq.			
3d Equation		+	3	53												
M. Time 3. equated	8	6	21	38												
4th Equation		+	1	6												
Orbit N. ☽ 2180 *Jul.*	8	6	22	44												
5th Equation		+	9	37												
Ecl. N. ☽ 2180 *July*	8	6	32	21												

The ANSWER.

2180 ſince *Chriſt*, O. S.

Orbit N. ☽, *July* 8^d 6^h 22^m 44^s	}	*Greenwich,*
Ecliptic N. ☽, *July* 8^d 6^h 32^m 21^s	}	req^d.

A general and particular ECLIPSE-MAP, *of* 22 *by* 14 *Inches, with a general and particular* ACCOUNT *of the* Annular Eclipſe *of the* Sun, April 1, 1764, *to be had at Mr.* Fuller's, *ſerving for Purpoſes of Aſtronomy after the Eclipſe is over.* [*Price* 2*s.* 6*d. together.*]

Correction, Pal. 1764. — P. 109, L. 23, r. x for Sine Co-Lat. L. 24, r. $b\sqrt{1-xx}+avx=$ S. ☉ Decl. L. 25. r. = Tang. Co-Lat. L. 28, r. Tan. Co-Lat. L. 29, r. Sine ☉ Declin. is known. L. 33, r. Sine ☉ Decl. Ditto, r. *Sum* of the Rectangle, &c. becauſe x denotes Sine Co-Lat. inſtead of *Sine* Lat.

P. 52, L. 9, $\frac{3a}{8}$ may be = any Value; becauſe a may = any Quantity to which x is equal. Theref. what holds good in *Generals* holds good in *Particulars.* P. 41, L. 9, r. *Numbers to a Sec. of a Deg.* — Reader, judge who is *Leader in Plagiary.* We have done with writing to, and anſwering, any impertinent and confident *Objectors* to our *Plan*—that others may fight their own *Battles* of Scurrility!

ERRATA *in this* Supplement.

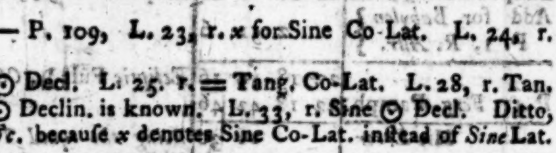
P. 22, for 1780 . . 14 21 33 3 Read 24 21 33 3

P. 31, L. 20, for 48^s Read 58^s

NEW MATHEMATICAL QUESTIONS.

I. *An* USEFUL QUESTION. *Propoſed by Mr.* EDWARD JOHNSON, *Mathematical Maſter, at* Hull.

LET AEB repreſent a *Syphon* laid over the *Bank* H, in Order to drain the *Reſervoir* G, into the *River* R. The *internal* Area of the End A (of a *ſquare* Form) is equal to 16 ſquare Feet; and the Length of the *Leg*, AE, is equal to 30 Feet; the perpendicular Height of E, above A, is equal 10 Feet; alſo the Height of



the Water's Surface at FG, above that at AR, taken at a *Medium* (becauſe the Water in the *River* R ebbs and flows with the Tide) is 4 Feet. From whence it is *required* to determine the *Quantity* of Water this *Syphon* will diſcharge in a given Time? (As for *Example*, in one Minute; the Area of the Surface at EQ being about 100 ſquare *Miles*, and therefore its perpendicular Height cannot be ſenſibly diminiſhed *in ſo ſmall a Time.*) — When the *Syphon* is full of Water and both Ends ſtopped, *required* alſo the *Preſſure* upon the *Door* at A; and alſo upon the whole *Leg* AE?

☞ *Such a* Syphon *as is here deſcribed is now laid over the Bank of the River* Hull, *to drain the Country which is overflowed about* 20 *Miles long*, 5 *Miles broad, and* 4 *Feet deep; but is not yet finiſhed.*

N. B. The above *Queſtion* may ſerve as a *Pattern* for our *mathematical* Correſpondents: Who, beſides what is uſeful or elegant, in *ſpeculative Reaſoning*, ſhould ſend us what is really uſeful in the Practice of Life. Who ought to look upon every mean Trifle ſent us, and pilfering *Plagiariſm* from the Works of Others, (except to illuſtrate ſomething new and uſeful,) as a Scandal to Reputation, and as deſtructive of uſeful Science and Improvement.

QUEST. II. THE *Sum* of all the *Sines* that can be erected on a *quadrantal* Arch is equal to the *Square* of the *Radius*. Required the *Demonſtration*?

QUEST. III. IN what Latitude *North*, on *September* 22, 1764, *will the Sun be one Hour in Riſing*?

On Modern Mathematical AUTHORS *and* CRITICS. *Qui capit, ille facit.*

SOME EMERSONS — and ſome would JOHNSONS be, —
Though hardly *verſ'd* above the *Rule of Three*;
And *Critics* ſome, not paſt their A, B, C.

Remark. The Prize Solut. laſt *Pal.* objected to, as Nothing, by a Gentleman who calls himſelf *Danmonium*, (quere *Danmonienſis*,) though the Method may be ſeen in the beſt Writers on Fluxions; and though $\frac{aa-xx}{a-x}=a+x,=2a$, when $x=a$, as by *Fluxions*. Alſo △ FDH ſim. △ BCF (he diſputed) at P. 11 of this *Supplement* is proved true.

NEW NAVIGATION.

By the AUTHOR *of the* Royal Aſtronomer and Navigator. (*See* Pal. 1755, *P.* 12.)

TO find the Latitude the Ship is in at Sea, from two Obſervations on the ſame Forenoon, and the Diſtance of Time between them.

EXAMPLE. Let the Sun's Altitudes, on the ſame Forenoon, be taken 20°, and 23° 10′, at Half an Hour between them, by the Watch; when the Sun's Declination is 12° 36′ N.

PRACTICAL SOLUTION.	*Logarithms.*
Diſt. of Obſervations, in Time, $=3c^{m}$ $=7°\ 30'$ Sine Co-Ar.	0.884302
Comp. of the Sun's Declination, 77° 24′ N. Sine Co-Ar.	0.010587
Difference of Altitudes 3° 10′ Sine	8.742259
Complement of Latitude, *nearly*, = 25° 42′ Log. S.	9.637148

☞ This Complement of Latitude being always ſomething *too little*, it muſt be ſuppoſed ſomething *more*; and Caſe the 11th of *Spherics* will give the *true* Complement of Latitude very near = 26° 0′. The Hour ∠ from Noon, as above, at the 1ſt Obſervation = 70° 2′; and at the 2d Obſ. 62° 31′; Dif. 7° 30′, = 30^{m} Time, given; Which ſhews this *practical Method* to be *very uſeful at Sea*. Hence, the Latitude = 64° N. and nearer Times of Obſervation $7^{h}\ 19^{m}\ 52^{s}$, and $7^{h}\ 49^{m}\ 52^{s}$, Morn.

This *new Method* of *finding the Lat. at Sea* may be alſo uſed in two Aft. Obſervations; or in one Obſervation before, and another after, Noon; being moſt uſeful at the Time when the Sun's Alt. increaſes or decreaſes the *faſteſt*.—See another Method of *Solution*, P. 34, *Pal.* 1756: Compare this with Mr. *Maſkelyne's* Method of Solution in his *Mariner's Guide*.

N. B. *Herein Refraction is ſuppoſed to be allowed.*

To

Table for Obſervations taken at Sea.

Eye above Sea.	Dip of Horizon.	Diſt. from Land	Eye above Sea. Feet.			
			10	17	27	39
			Land below Level.			
Feet.	Feet.	Feet.	F.	F.	F.	F.
1	1	¼	23	38	61	88
4	2	½	11	19	30	44
10	3	¾	8	16	20	29
17	4	1	6	10	15	22
27	5	1¼	5	8	12	18
39	6	1½	4	7	11	15
53	7	2	3	5	8	12
69	8	2½	3	5	7	10
See *Maſkelyne*'s Mariner's Guide.		3	3	4	6	8
		3½	3	4	6	7
		4	3	4	5	7
		5	3	4	5	6
		6	3	4	5	6

To find the Difference of Longitude at the Ship from Greenwich.

IN obſerving the *Moon*'s *Edge* from a Star, or from the *Sun*'s *Edge*, at Sea, take a Sweep with the *Quadrant*, that the Angle of the *neareſt Diſtance* may be taken, for determining the *Moon*'s Difference of Longitude, from the Sun, or the Star obſerved at that Time; whoſe *Altitudes* muſt be taken at the ſame Time. Whence, the *Moon*'s true *Places*, and thence the Difference of *Longitude* at the Ship, from *Greenwich* Obſervatory, may be determined, (*from the Moon's Places correctly computed for every* 8 *or* 12 *Hours in a Triennial Ephemeris*,) *within a Degree, or two, at moſt*, better than by any uncertain *Time-piece* whatſoever. —The *only Difficulty* in this Obſervation is, to make a due Allowance for the *Effect* of the *Moon*'s *Parallax* (in Diſtance and Altitude,) and *Parallax* and *Refraction* of both *Luminaries*. The great Uſe of this Method of determining the *Longitude* at Sea, from Obſervation, when facilitated and perfected by ready *Tables* computed *for the Purpoſe*, will appear from a *few Trials*, made by good Inſtruments, and Obſervers verſed in the proper and eaſy *Computation*.—Or a *mechanical* Method will readily ſolve this *important Problem*.

Proper Diſt. of Knots on the Log-Line, for different Glaſſes.

Glaſſes.	Diſt. betw. Knots.	
Seconds.	F.	Inch.
24	40	0
25	41	8
26	43	4
27	45	0
28	46	8
29	48	4
30	50	0
31	51	8
32	53	4
33	55	0
34	56	8
35	58	4
36	60	0

According to *Norwood*, 69½ Miles in a Degree, or 367300 Feet; to have the Reckoning a-head of the Ship.

The Running of Currents, in Places of *Trade-Winds*, and elſewhere, with the caſual Storms, driving a *Ship* from her due Courſe, will ſometimes make her deviate, in her Reckoning, 5, 10, or more Degrees, from her true Longitude, in a *long Voyage*; which may, this Way, with Certainty and *little Expence* to this Nation, be properly corrected; would the COMMISSIONERS OF LONGITUDE encourage the *Computation* of a correct TRIENNIAL NAUTICAL EPHEMERIS, and NECESSARY TABLES, *adapted for the Purpoſe of finding the Longitude, by Obſervation, at Sea.*

☞ The *Honiton* Aſtronomer (*Bamfield for ever!*) propoſes to find the *Diff. of Long.* by the Diff. of the ſame fixed Star, ſouthing at different Meridians; who ſhrewdly, (by the Help of *Robertſon's Nav.*) P. 38 of his *Aſtronomy opened*, determines the Diff. of *Arcturus*' Southing at *London* and at the Ship, to be 4^{h} 47^{m}, for the Diff. of Long. between *London* and the *Ship*; though himſelf, in the preceding Page, admitted, that the *fixed Stars* come but 4^{m} (or 3^{m} 56^{s}) ſooner to the *Meridian* each Day, for 360° Dif. of Longitude; which is but 39⅓ *Thirds*, or *Two-Thirds* of a *Second* of Time, for 1 Deg. Dif. of Longitude; ſo that about 7 Seconds *Error*, in *Time*, will create about 10 Deg. *Error in Longitude: A rare Diſcovery!* Which Author ſuppoſes *Contradictions* not in Nature.—Such is *all* his *Opened Aſtronomy* — dedicated to an *honourable Member*, his Friend. *Plaudite!*

FINIS CORONAT OPUS.